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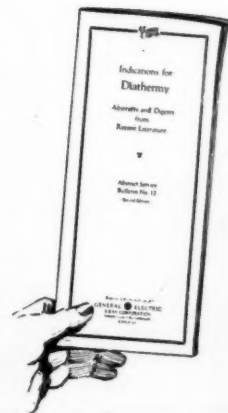
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BY BENJAMIN GOLDBERG, M.D., F.A.C.P.

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The story of the beneficent influence of sunlight is coeval with the story of man. Every ancient religion of which we have record is bound up, indissolubly, in the tenets of sun worship.

"'Let there be light,' said God; and
forthwith light,
Ethereal, first of things, quintessence
pure,
Sprung from the deep."

This quotation from Milton exemplifies the aphorism that light is life. Without light, as we understand it, metabolism is impossible, and the vital processes of the higher organisms, at least, inconceivable. The destiny of our material universe, and of everything animate in it, has been supremely directed and developed through the influence of the sun.

It is not strange, therefore, to find that every race of human beings, from the times beyond the ken of history, has looked upon the sun as a source of comfort, of healing, and of life. Even the lower species of animal life are sensitive to sun influence, and are, many of them, dawn worshipers. Any one who spends a night in the woods, in the spring or summer, is aroused at dawn by the universal bird chorus of jubilation. Cock-crow, the reaction of the cock to the glory of the coming day, has become synonymous with the dawn. In the jungle the apes, in the mystic moment as the new day is born, beat their breasts in frenzy and shout an inarticulate hymn to Apollo, the sun-god.

It is not strange then that sun worship has been the leading motif in all ancient religions. Love of light is a primary instinct bound up inextricably with love of life. The huge mysterious orb that daily swung across the sky meant to the primitive man warmth, comfort, security, food, health. It meant light as against darkness, tangible things as against demons and devils of the night. It was, therefore, natural that the sun should acquire the

most resplendent thrones of the hierarchy of ancient divinities. The sun-god exorcised the demons and drove away disease. We may well suppose that the worship and reverence bestowed on the sun were, to a certain extent, proportional to the developmental stage of the human mind. It is only reasonable to think that man, during the first stages of his transition towards consciousness, must have been inconceivably impressed and subdued by the daily mystery of the sun. The feeble half-lights of an awakening reason must have clutched pitifully for a solution. Primitive man, half ape and half soul, must have wondered endlessly concerning the huge globe, the source of his heat and of his light, that daily rose and set in a blaze of mystic supernal glory.

Historical Note

Within the range of historic times the Babylonians, the Egyptians, the Hebrews and others deified the sun and erected temples of sun worship. Among the Egyptians, particularly, sun worship as a cult reached a position of extremely high development. Over 3,000 years ago Ikhnaton embodied traditional beliefs and rituals into a definite religion. The sun-god was known as Aton-Ra. The prayers of the Egyptians, handed down from the twilight ages beyond the pale of history, were now addressed to Aton. The devotee beseeched "that the sun's rays might spread over his body"; that he might be permitted "to go out from the underworld in the morning to see Aton as he rises."

The appellative of the sun-god—the Ra—was incorporated into the names of the Egyptian kings (the sons of the sun), as is seen by consideration of the word Pharaoh (Pharaoh-o). The old divinity, under the new name, was the potent, the life-giving, the essential influence. The sun-god was the god of fecundity and of fertility, that regulated the well-being, the health, and the generative and reproductive processes of everything that



We see King Ikhnaton, the great apostle of the sun, his queen, Nefertiti, and their children, bathed in the down-streaming sun rays. The disk of the sun is represented as a huge, effulgent orb, surrounded by hieroglyphic emblems of adoration. The rays are depicted as radiating downward in healthful beneficence toward the earth. At the end of each ray is shown a hand signifying celestial providence placing its kindly, healing touch upon the world and the affairs of men. As may be seen, the children are naked and are held up for the blessing of the sun-god. It will be noted in the picture also that the rays of the sun immediately before the nostrils of King Ikhnaton and his queen terminate in a hand which holds the hieroglyphic emblem signifying life.

lived on the land, in the air, or in the sea. In Babylon Baal and Mardouk were sun-gods and were revered as deities of the harvest and creation.

Among the ancient Iranio-Persian peoples light and darkness were the opposing influences for good and evil. Zoroaster (or Zarathustra) who supposedly flourished about 600 B. C. and who is credited with portions of the Avesta, was the founder of an ancient religion which is held to this day by the Parsees and Guebers. According to this ancient Persian cult Ormazd is light and life, the creator of all things pure and good. His antithesis, Ahriman, is the evil spirit, the spirit of darkness and death and filth, the deity responsible for disease and evil. Next to Ormazd, the god of light and goodness, and approaching him in munificence and magnificence, came Mithra, the sun-god. Mithra is personified as an ubiquitous, all-seeing and omniscient god, in constant battle with the powers of darkness, and is pictured as the chief ally of Ormazd in his struggle with Ahriman, the spirit of evil.

In Greek or Roman culture Helios and Apollo, the sun deities of classic mythology, received their due meed of veneration and worship. Apollo is the sun-god, the god of light, and at the same time the patron of youth, beauty, music, flocks and herds. In other words, Apollo is the god of fertility and fecundity, of life and health and happiness. Apollo is a reincarnation, in fact, or rather a re-deification if we may use the word, of Aton-Ra, the Egyptian sun-god, and of Ormazd, the Persian god of light. In all the ancient mythologies the conceptions are quite similar; the sun is worshiped, first as the source of light, and as a corollary, as the god of life and health. The idea of the sun as a healing agency has been immemorially prevalent, has been at all times, according to all tradition and all historic record, universally compelling. The belief has influenced the destiny, has painted lights and shadows in the culture, in every race of which we have knowledge.

In view of this immemorial belief it is strange that no greater attempts have been made to secure actual therapeutic advantage from the healing influence universally attributed to the sun down through the ages. History, indeed, indicates that in addition to the

mere ritual of sun worship, efforts were made at various times to realize on the healing properties of sunlight. What the writer wishes to emphasize, however, is the fact that the efforts made do not seem to be commensurate with the fervency of universal belief.

The earlier procedures of heliotherapy were, of course, empiric, probably the result of the sense of well-being and comfort that one experiences in the sunshine. Herodotus is perhaps the first who goes into detail concerning heliotherapy as a routine measure. Over 400 years before the Christian era Herodotus, as quoted by Oribasius wrote: "Exposure to the sun is especially indispensable to people requiring restoration and increase of musculature. One should take care that in winter, spring and autumn the sun should have a direct access to the sick person; in summer and in the case of feeble individuals, this method is to be avoided; the head is to be covered during the cure." As far as the underlying principle is concerned, this might have been written yesterday. Herodotus chronicled that light was to be considered by the physician as both a prophylactic and curative influence.

Hippocrates later, 460-377 B. C., traced the action of sunlight, and it is said was accustomed to prescribe sun-baths for his patients. Antyleus in 300 B. C. was also a believer in heliotherapy, and laid down in detail the routine of the sun-bath. We quote in part: "Many set themselves in the sunlight partly anointed, partly not. Let those who lie stretch themselves out in the sunlight on a mattress, a skin in the sand, or in the open sun. The sun's rays, which should be used with caution when not anointed, increase the internal transpiration, evoke perspiration, check increase in girth, strengthen the muscles and reduce fatness." Speaking of the routine he proceeds as follows: "The skin should be large, steeped in oil, spread over a thin surface of sifted sand. The patient should lay himself thereon where it first becomes warm, his head bound with unbleached linen. When his body is thoroughly warmed throughout, he should change his position and turn over, then lay himself on the other side and so rest again, repeating this changing and turning many times."

Evidence seems to indicate that the sun bath amongst the Greeks was an accepted

method. The treatment was termed heliosis. The sun devotees lay down on the terraces of their homes, on the ground about the temples, or on the sand.

In the later days of Greco-Roman civilization Celsus, Galen, Cicero and others discuss or mention heliotherapy procedures. Cicero and Pliny discuss the fact that the leading citizens of Rome were accustomed to have solariums constructed in their homes; at the seashore, "arenarias were provided for a complete exposure of the nude body."

In the *thermae*, or public baths, solariums were likewise available, in which the effect of the bath was enhanced by heliotherapy.

At Pompeii, among the ruins, we still see the solariums on which the Roman fashionables were accustomed to take their sun baths. Likewise, recent excavations in the location of the ancient mineral springs, or health spas, indicate that heliotherapy was an adjunct to the "taking of the waters."

During the middle ages heliotherapy, in common with everything worth while in arts and science, fell into disuse and stagnancy. The mysticism of this period and the effects of migratory movements impeded or obliterated scientific and cultural progress. These were, indeed, the dark ages, of which Homer might have truly said, "Why hast thou left the light of the sun, thou poor one?"

The Jewish physicians and the Arabians seem to have been the only ones who kept the fires burning on the altars of the sun-god. Avicenna (980-1056) recommended and outlined the course of sun baths for his patients. Paracelsus, that extraordinary blend of charlatan and scientist, was also interested in heliotherapy. He was probably the first to emphasize the value of a mountainous climate, and recommended in this respect the region about St. Moritz.

The history of the early Renaissance, as far as we know, holds little of interest in the matter of heliotherapy. It was not until the 17th or 18th century that we again notice any degree of interest in the subject. It appears that to the French must go the credit for the re-awakening of interest in sun treatment. Rousseau, in his *Back to Nature*, and other of the French writers, drew attention to the potentialities of sunlight. In 1735 we note an example of local measures for the application of heliotherapy. Thomas Fiennus in 1735

used sunlight concentrated through the lenses in the treatment of cancer of the lip. In 1774 we have probably the first scientific report of a heliotherapy procedure. Faure, in this year, before the Royal Academy of Paris, presented a paper which dealt with the treatment by sunlight of scars, tumors and wounds. In 1776 LePeyre reported the treatment of ulcers by means of sunshine concentrated through a lens. Cauvir in 1815 published a paper entitled *Les Bienfaits de l'insolation*. In that paper he says: "Speaking of scrofulous infants, send them to the country, feed them up as well as possible, but above all, make them roast, burn, roast in the sun." In the same year Loebel published a paper of far-reaching importance. In this paper the author recommended sun therapy in disorders of the vegetative system—in intestinal troubles, stomach spasm, diarrhea, dropsy, gout, rheumatism and nervous disturbances. The contra-indications given by Loebel are still of interest today. As contra-indications he lists blood spitting, hemorrhage, congestions, stomach and bowel disturbances, acute inflammatory conditions and lung conditions associated with inflammation.

The further elaboration of heliotherapy was promoted to a large extent by the French school, particularly Bonnet. In 1840 Ollier and Poncet of Lyons reported cases of tuberculous arthritis treated by sunlight. Bonnet, in 1845, further emphasized the importance of heliotherapy in arthritic disorders and advocated general sunlight treatment in conjunction with the local application. In 1855, Rickli, a Swiss, who was not a physician, published his interesting article entitled *Le Cure Atmospherique*. Rickli had founded a clinic at Veldes, Austria, in which the chief feature of treatment consisted of sun baths.

The March of Scientific Developments

Before proceeding further, it may be well to consider briefly the march of scientific development which forms the basis for our present system of heliotherapy. The whole theory of the therapy with invisible radiation, as we understand it, must be traced back to the Newton epoch-making discovery—the spectrum.

In 1777, Scheele made the discovery that when the visible spectrum was projected upon silver chloride, metallic silver was formed in the region of the violet rays. The actual discovery of the rays, however, was made by

Ritter in 1801. Grotthus, in 1819, elaborated the first law on photochemical change. In 1800, Sir William Herschel discovered the infra-red region. In 1842, Becquerel photographed along the ultraviolet region. In 1895, the x-ray was given to the world by Roentgen. The x-rays are of extremely short wave length and between them and the ultraviolet rays a large gap existed. This gap has been closed by more recent research.

Schumann, Lyman, Millikan and others, who bring the research up to the present day, have been so successful in improving spectroscopic methods that at the present time the wave lengths of the known forms of radiation comprise an almost continuous series.

Further Developments of Therapeutic Procedure

The three individuals most concerned with the further development of modern heliotherapy were Bernhard of Samaden, Rollier of Leysin, and Finsen of Copenhagen. Many others, of course, took part in the work. The limits of this article, however, do not permit us to consider in detail their careful and conscientious efforts.

Niels Ryberg Finsen (1860-1904), born of Icelandic parents, spent his early boyhood at Reykjavik, the capital of Iceland. The long, bright summers and the dark winters of the region caused him to become particularly interested in the subject of light. He was graduated from the University of Copenhagen in 1890, and soon began to conduct experiments on the physiological effects of light. In 1893 he published a paper on the treatment of smallpox by red light. He eliminated the ultraviolet, or chemical end of the spectrum, in the belief that the ultraviolet ray, which would excite inflammation in normal skin, could, for the same reason, aggravate an already existing inflammation.

Previously to this, in 1889, Widmark, of Stockholm, had demonstrated that the inflammatory change in the skin, which formerly had been attributed to heat or infra-red rays, was actually due to the blue, violet and ultraviolet segment of the spectrum, or the chemical segment, as it may be called.

In Finsen's further experimental work he proved definitely that the actinic rays found in the blues and violets of the spectrum possess the curative and stimulating properties inherent in sunlight. In April, 1896, he founded

his light institute at Copenhagen, and was particularly successful in treating the various types of skin tuberculosis. A summary of his report showed that 98 per cent of cures had been effected in the treatment of 2,000 patients.

Finsen's first experimental and therapeutic work with the carbon arc lamp was rather disappointing, as his arc was inclosed in glass which absorbed the greater part of the ultraviolet ray. The lamp was later improved by himself and by Kjeldsen. Later, Reyn and Ernst demonstrated the therapeutic efficacy of complete bodily exposure to the carbon arc.

Finsen was the outstanding pioneer in the promotion of artificial heliotherapy in the same way that Rollier was the outstanding pioneer in the advancement of natural heliotherapy. Finsen died in 1904. Shortly before his death, he had been awarded the Nobel prize of 100,000 crowns. Half of this he gave to the institute; the other half he arranged should be turned over to the institute on the death of his heirs.

In 1902 Bernhard used sunlight to treat a suppurating abdominal wound. He had noted that the Swiss butchers dried their meat in the sun; this observation and the success achieved by Finsen in employing artificial sunlight impelled Bernhard towards his sun treatment experiments. He subjected to the direct sunlight badly healing wounds, and later, cases of external tuberculosis. In 1903 Rollier opened his sanatorium at Leysin, and began his epoch-making work. The clinic was situated in the Alps of the Canton Vaud, at a height of 1300 meters. It was the first clinic devoted exclusively to the systematic treatment of external tuberculosis by heliotherapy.

At this altitude the air in the summer time is never oppressively hot; in winter the rather intense cold is counteracted by the continued brilliancy of the sun. The patients at the Rollier institution were given the benefit of cool fresh air, and of brilliant sunshine applied by means of sun baths to the whole surface of the body. In his book, "Heliotherapy", published in 1923, Rollier stated that there were 1200 beds in his institution which were divided among 34 different clinics, placed at an altitude of 1250, 1350 and 1500 meters, respectively.

Rollier's example was soon followed. Heliotherapeutic institutions developed on the

Mediterranean, on the seashore, in the mountains, and even on the inland plains of different countries. The evolution of the heliotherapeutic institute is even yet, by no means a closed chapter.

Notwithstanding the splendid results achieved by Rollier, progress has not been as rapid, nor expansion as universal as might have been desired. The future, we think, holds the germ of more rapid progress in this direction. As Gauvain says, "Rollier is the 'High Priest' of the modern sun worship; he has led us back to sunshine and simplicity, to the first principles of light and life."

Advance in Heliotherapeutic Apparatus

Advance in mechanical apparatus has kept pace with the scientific progress in heliotherapy. From the first, two distinct types of apparatus have been favored: the carbon arc lamp and the mercury vapor arcs in vacuum. The lamp, as first used by Finsen, contained a carbon arc light of high candle power. The light, as developed, was concentrated by a series of water-cooled quartz lenses. Finsen aimed at the production of a light with the maximum ultraviolet and the minimum heat-ray content. For the local application Finsen devised an appliance consisting of a brass ring, inclosing water-cooled quartz lenses. In local treatment this apparatus is pressed against the skin; it cools the surface and expels the blood from the area to be treated. The carbon arc most closely approximates the composition of the solar spectrum.

Knowledge of the mercury arc lamp may be said, perhaps, to date from 1835, when Wheatstone noted a brilliant bluish white light as the result of vaporization of mercury in an electric arc. Later, Peter Cooper-Hewitt used thallium and caesium in the construction of quartz mercury arcs in order to increase the percentage of ultraviolet radiation. About 1901 the Cooper-Hewitt mercury lamp was perfected.

It may be noted that the original reason for the use of quartz lay in the fact that its melting point was extremely high, about 1700 degrees Centigrade. The essential feature of the quartz, however, is that it permits the penetration of about 1,000 times as much ultraviolet radiation as does ordinary glass.

Kromayer was among the first to use the quartz light for treatment (1904). He saw

the necessity for devising apparatus for local application, and accordingly invented the water-cooled vapor quartz lamp, which bears his name.

In all probability, the end of the road is not yet reached in the matter of heliotherapeutic appliances. Undoubtedly the future will lead to much greater improvement in sun lamps. In addition to the carbon arc and the mercury vapor arcs, lamps using tungsten, nickel, zinc, iron, magnesium, etc., to form the arcs, have been devised. There is still room for exploration in this field.

Large sun units for mass treatment are a development of recent years. In schools, sanatoria and other institutions the problem of individual treatment, or treatment in extremely small groups, is a serious one. Simultaneous exposure of comparatively large groups to ultraviolet radiation was an objective that had seemed, for some time, desirable. To meet this objective, advanced types of large units have been devised. In this respect, it may not be amiss to describe briefly the apparatus constructed, under the supervision of the writer, at the Spalding School for Crippled Children in Chicago.

The apparatus consists of a sheet metal room, 8½ feet wide, 20 feet long and 9 feet 2 inches high. The "sun room" is elevated about 15 inches from the floor and approached at both ends by ramps, 6 feet in length, graded 2½ inches to the foot. The room is open at each end and a conveyer, on the endless chain principle, runs its entire length. This conveyer (on which the children travel) is by means of the tachometer control, adjustable in speed. The rate is controlled by a speed reducing unit which enables the conveyer to travel the length of the chamber at speed variations of from ¾ to 4½ minutes for the distance of the chamber.

Running down the center of the conveyer are two heavy black lines about 9 inches apart. The children to be treated stand between these lines during their passage through the "sun room." On each side of the chamber, or "sun room," 2½ feet from the floor, are placed 3 Uviarc lamps, making a total unit strength of 6 mercury quartz lamps. The lamps are supplied with special adjustable reflectors which are constructed to give an even distribution of light at all angles. Additional reflection is obtained because of the fact that

the whole interior of the chamber is coated with aluminum paint.

In order to maintain a comfortable temperature level, exhaust fans have been installed at the top of the chamber. These fans promote a breeze of approximately 10 miles an hour and afford a twofold advantage of reducing the temperature and supplying air currents to the skin.

A control board at one end of the unit allows individual control of each arc unit within the chamber and also, by means of the tachometer, permits the necessary regulation of the speed.

The intensity of exposure is controlled in three ways:

1. Through the speed of the conveyer.
2. Through the voltage control transmitted to the mercury arc.
3. Through the curtailing of the number of arcs in use.

The method of treatment is simple. The graduated ramp which approaches the entrance will accommodate children on wheel chairs, stretchers or crutches. The children are placed between the two lines; in their course through the sun room they are kept equidistant from the two sides of the battery units. Standing, or in wheel chairs, between the lines, they are at a distance of approximately 40 inches from each side.

Depending on the amount of exposure they have already had, the children are coursed through the sun room at any indicated speed, varying from forty-five seconds to four and a half minutes. They are sent through in groups based on relative sensitivity and are carefully observed for results.

It has been found that an exposure of forty-five seconds with the full battery of lamps at a voltage of 75 produces only a very slight erythema in approximately 50 per cent of the children.

As to capacity for early exposure, approximately 250 children can be handled in an hour. A nurse stands at each entrance to help the children on and off the conveyer. As they go through the room the children wear only a breech cloth and goggles to protect the eyes. The apparatus has been in operation only a few weeks at the time of writing. A large number of children are being treated and careful data are being prepared for further consideration.

Many new chapters are about to be written into the story of heliotherapy. Sun treatment is ceasing to be a novelty and the advocating of sun treatment is no longer regarded as an oddity. We are coming to realize the importance of sunshine, not only in the cure and alleviation of disease, but also in the preservation and promotion of health. Heliotherapy today is a lusty youngster, a little boastful of his prowess and capabilities but holding, nevertheless, the germ of great possibilities for the health and happiness of tomorrow.

Physics

A few broad considerations of the physical characteristics of radiant energy are in order in a discussion of heliotherapy. Sir Oliver Lodge has defined Light as "an electro-magnetic disturbance of the ether." Light is conceived as consisting of waves of varying lengths that travel in every direction from the point of propagation, at a rate of 186,300 miles per second. When a beam of light is passed through a prism it is broken up into the colors of the rainbow. The colors—red, orange, yellow, green, blue and indigo, as revealed through the agency of the prism, represent the visible spectrum.

This visible segment, however, constitutes by no means the entire electro-magnetic spectrum. Luckiesh, indeed, says that if the electro-magnetic spectrum could be projected as one view and the visible portion were one foot long, "the entire spectrum would be several million miles in length."

The invisible spectrum, consequently, constitutes a most important phase of the radiant energy. At one end of the visible spectrum is found the invisible infra-red, consisting of wave lengths that grow longer and longer the lower we go beyond the visible red, to the Hertzian employed in both radio and diathermy. At the other end of the visible spectrum beyond the violet, occur invisible ultra-violet rays that grow shorter and shorter the farther we go beyond the violet. At this end, still beyond the ultraviolet rays, occur the x-rays and the gamma rays of radium and, finally, the cosmic rays recently described by Millikan.

In recent years, spectroscopy has made such progress that the measured wave length of the known forms of radiant energy comprises an almost continuous series. Millikan has photographed the ultraviolet spectrum and

determined wave lengths down as far as 136.6 Angstrom units in the spectrum of aluminum. As the longest x-rays measure 13.3 Angstrom units, it will be seen that only a small gap exists between the shortest ultraviolet and the longest x-rays.

The Angstrom unit—one ten-millionth part of a millimeter—is the unit generally used for the measurement of the waves of radiant energy. It is a wave length characteristic of the radiant energy just beyond the ultraviolet rays and approximately the wave length of the softest of the x-rays. This is an entirely arbitrary measuring stick and enables us to talk of the extremely short gamma rays of radium in terms of tenths and hundredths of the Angstrom unit. It enables us to talk of x-rays in terms of tens, in ultraviolet radiation in figures approximating three thousands and of visible light in figures up to about seven thousands. In the infra-red region it is customary to change to the micron and millimeter scale, and as the wave length increases, to the usual metric measurements.

Two other units have also been adopted as measuring sticks—the millimicron and micron. The micron is the thousandth part of the millimeter and millimicron is the millionth. These terms are easily interchangeable with the Angstrom unit. For instance, millimicrons are converted into Angstroms simply by adding another zero, for example, six thousand millimicrons equal sixty thousand Angstrom units.

In addition to wave lengths, in speaking of radiant energy, we may consider velocity and frequency. Velocity is constant and approximates 186,300 miles per second. The frequency varies inversely as the wave length, the shorter the wave length the greater the frequency.

The long red rays have a comparatively small number of vibrations. The short ultraviolet has about six hundred trillion per second. It is perhaps to this factor, the very great frequency of the short actinic rays, that we must attribute the special chemical activity of the ultraviolet ray.

Composition of the Visible and Invisible Spectrum From the Gamma Region to the Infra-Red

	Angstrom Unit
Gamma rays	1
Roentgen (arbitrary limits)	1—500
Ultraviolet	2000 (extreme) to 4000
Visible Spectrum	4000—7000

Violet	4000—4300
Blue	4300—4700
Blue Green	4700—5000
Green	5000—5300
Yellow Green	5300—5600
Yellow	5600—5900
Orange	5900—6200
Red	6200—7000

The ultraviolet region is again divided by some into near, middle and far fields. The near field, between 3800 and 2960 Angstrom units, is biotic, of slight germicidal action and increased penetrability. The region between 2960 and 2100 Angstrom units, the abiotic region, has considerable germicidal action but comparatively low penetrability. The region between 2800 and 2100 Angstrom units is reputed to be endowed with the maximum degree of bactericidal efficiency. The long ultraviolet rays are said to be biologic in function because they penetrate tissue and stimulate chemical activity. They presumably never penetrate to a greater depth than one-half millimeter. Even with this slight penetration, however, they are said to be absorbed by the unsaponifiable lipoids of the blood plasma. By the blood plasma they are carried to the various tissue cells to promote their characteristic effects.

The short actinic rays in the far region between 2800 and 2100 Angstrom units, are readily absorbed by the cell protoplasm. As a result of the absorption, coagulation and depression of cellular activity occur. The physiologic action of the various rays will be taken up in detail later.

Physiological Considerations

As indicated in the historical section, it has always been more or less known that sunlight exercises a favorable action on the living organism. The reason for this favorable therapeutic action has, in the past, been completely unknown.

Today, we are commencing to learn a little concerning the nature of the reaction which sunlight exercises on the living organism. There remains, however, much yet to learn. We are still enmeshed in a network of conflicting theory and we struggle bravely between fact and fancy. The universal attention directed to the problem and the prominent men interested in its solution, doubtless gives assurance that in the near future many of its puzzling phases will be solved.

We know, in a general way, that sunlight

is essential both to the growth of plants and the growth of living organisms; that sunlight influences certain phases of metabolism, particularly phosphorus and calcium metabolism; that sunlight has definite bactericidal qualities. We know also, from recent work, that sunlight does not act as a whole. We have learned from the work of Finsen and others that the different rays have different actions. We know that the extremely long Hertzian rays are used for radio telegraphy; we know that the somewhat shorter infra-red rays, as their frequency increases, supply heat. When the frequency increases still more the infra-red merges into the visible red rays. We know that the range of visibility extends from wave lengths of 7700 at the red end of the spectrum to a wave length of 3900 Angstrom units at the violet end. We have learned that beyond this range of visibility we encounter an environment purely of invisible ultraviolet rays. We know that they are germicidal, tonic or toxic depending on the dosage. We have even learned that in the comparatively small ultraviolet segment, the action of the component rays is not uniform, that the ultraviolet segment, indeed, has been divided, as stated, into three parts, the near, the middle and the far ultraviolet fields. The near ultraviolet field has slight germicidal action, the middle and far fields have increasing bactericidal efficiency.

It will be seen, then, that the action of sunlight is, of necessity, quite complicated; the correct analysis of sunlight action requires the most exact refinements of modern science and the most painstaking study on the part of conscientious scientists.

In this section we will attempt merely to furnish a cursory summary of some of the accepted beliefs concerning the action of sunlight.

Local Action

As is well known, sunlight, either natural or artificial, will produce an *erythema*, the extent of which depends on the intensity of the light and the duration of exposure. The *erythema*, as was first shown by Charcot, is caused by the ultraviolet light. Five to eight hours after the skin has been exposed to an average dose of the quartz light, for instance, a hyperemia is noted which will last from three to ten days.

On microscopic examination, dilatation of

the capillaries is noted. There is serous swelling in the deeper layers. In some of the capillaries the circulation is completely impeded and thrombosis results. If the process is sufficiently advanced, enough exudation will be present to separate the upper layers of the skin from the lower with the formation of a blister. Twenty-four hours or more after the appearance of the *erythema*, edema accompanied by active diapedesis from the deeper free vessels is noted. The thrombi are removed by the process of phagocytosis.

As regards the causation of the hyperemia, it must be admitted that, at the present time, we are not in a position to give a definite answer to the question. It is believed by some that the absorption of the actinic ray splits up the chromatin of the cell and possibly liberates the toxin which acts as a local, stimulating influence to increase the blood supply.

Kohler has obtained, through the medium of ultraviolet radiation at 2800 Angstrom units, photographs which show the dividing cell nuclei in the gill plates of salamander larvae. If we accept this theory the extent to which the chromatin is split up will regulate the intensity of the reaction. An extensive destruction of the cell would result naturally in an intensive reaction. The severe constitutional effects from overexposure could be explained as a result of absorption of the toxic decomposition products.

It has been demonstrated definitely that *pigmentation* or bronzing is due to the ultraviolet ray. Pigmentation occurs with varying intensity and speed depending on the amount and duration of exposure and on the quality of the skin. Blondes or red-headed individuals, with fine-textured skin, do not pigment easily. They burn very readily unless precautions are taken. Brunettes, on the other hand, it is well known, take on a beautiful coat of tan.

While the exact reason of the tanning is not definitely established, it is caused, according to some, by the deposit of melanin granules. These granules, it is thought form a protecting screen about the skin cells and protect them from an overdose of ultraviolet rays. It is certainly a fact that patients who pigment easily and well can sustain a much larger dosage of the ultraviolet ray. Blondes and red-headed individuals who blister and

burn are often made quite ill by undue exposure to sunlight.

According to Smith, skin pigmentation is a product of reaction between an enzyme content in the epithelial cells and a colorless chromogen related chemically to dioxyphenylalanin.

Pigmentation gradually disappears. Even the intensely tanned patient, when withdrawn from sunshine or his lamp treatment, will gradually lose his tan after a few weeks, or perhaps, in some instances, months. In the absence of stimulation, the epithelial cells can not produce the pigment. As a result, in the process of cell division, gradual fading occurs. The pigmentation of the original cell is decreased by one-half in the process of cell division. When the pigmented cells die, the phagocytes remove the disintegrated pigment. By a combination of these processes, the pigmentation is gradually lost and the normal skin color restored.

Summary of Local Action

In the patient submitted to treatment with the average dose of artificial sunlight, the following findings will be noted.

Tingling and itching of the surface irradiated are felt, accompanied by a sensation of comfort and drowsiness.

Erythema occurs in the irradiated area after an interval of five to eight hours. The erythema is usually accompanied by some pain. After a few hours the pain lessens and the erythema becomes dark and colored. These changes are accompanied by a sense of well-being.

The area then becomes irritated and desquamation starts and continues for six or seven days. Following desquamation the part becomes pigmented or tanned; this pigmentation remains for varying periods of time and gradually disappears.

It may not be amiss to say a word concerning the power of penetration of the various types of radiant energy. Radiant energy of different wave lengths varies as regards power of penetration, as in other respects. As already indicated, even in the narrow ultraviolet band the penetrative power of the constituent rays varies.

Ultraviolet rays with wave lengths between 2000 and 2400 Angstrom units do not pierce beyond the *stratum corneum* of the epidermis. Actinic rays with wave lengths between 2500

and 3300 Angstrom units pass through the *stratum corneum* and are blocked in the *stratum mucosum* at the level of the living epidermal cells. Ultraviolet rays with wave lengths between 3400 and 3900 Angstrom units pass through the epidermis and reach the blood in the sub-epidermal capillaries.

The penetrative power of the rays in the visible spectrum gradually increases as we go toward the red. The visible red rays, with a wave length of 7900 Angstrom units, have considerable penetrative power and pass through the deep fascia to the muscles. As we progress into the infra-red region the penetrative power is again weak.

The rays as they strike the body incite one of two changes—heat production or chemical change. Starting from the infra-red region, we may say that these rays as they are absorbed, heat the tissues. Owing to the fact, however, that the penetrative power is slight, the heat distribution is superficial in character.

The rays of the visible spectrum, as they impinge on the body, lose their energy in the form of heat. Owing to the fact that they penetrate to a marked degree, even through the fascia layers, as stated, these rays produce heat down to a considerable depth. The ultraviolet rays of the near field, between 3800 and 2900 Angstrom units, that is the region with the longest wave length, has the greatest degree of penetrability and as they strike the body the rays are energized into heat, heating the blood in the sub-epidermal capillaries.

As the ultraviolet rays become shorter, reaching to the *stratum mucosum* and *stratum corneum*, respectively, heat production is not in evidence and the chemical changes become marked. The changes are destructive in character; if the radiation is sufficiently intense or the duration sufficiently long, cell death is followed by desquamation. The extremely short rays, the rays of the so-called "far" ultraviolet field, between 2800 and 2100 Angstrom units, act only on the horny layer of the epidermis. These rays are extremely bactericidal; this inherent quality, however, is greatly modified by the fact that they possess very slight power of penetration. Owing to this fact, although they have powerful germicidal properties, they can not destroy bacteria unless they act immediately upon them.

The bactericidal power of the ultraviolet ray is especially efficient in destroying the

tubercle bacillus. Direct exposure to natural sunlight kills the tubercle bacillus in a short time. It is, of course, to this fact that mankind owes its salvation. Unless a powerful, ubiquitous, destructive force were at hand to overcome the menace of ever present tubercle bacillus, mankind would undoubtedly, ages ago, have been completely destroyed by tuberculosis.

To summarize, then, going from the infra-red to the ultraviolet region, the infra-red rays and the visible light rays are thermogenetic. Their biological effects are the biological effects of heat. The ultraviolet rays also, with the longest wave lengths, are probably entirely thermogenetic. Their biological effects, consequently, are the biological effects of heat. The far ultraviolet field, on the contrary, the ultraviolet with the shortest rays, produces chemical reactions in the tissues and the biological effects depend on the nature and extent of these reactions.

It is rather strange that profound, physiological changes resultant from actinotherapy can be produced by radiation of such slight penetrative force. There are some who feel that the penetrative power of the ultraviolet ray is greater than is usually thought. Macht, Anderson and Bell feel that they have demonstrated by means of the spectograph and thermopile that the penetrative power of ultraviolet is considerably greater than hitherto reported.

Theories

Even granting, however, a somewhat increased penetrative power to the ultraviolet, this, in itself, does not explain the physiological sequelae of irradiation. What is the explanation of the physiological changes consequent to the use of ultraviolet treatment? There are many theories, none of which to date has final, scientific support.

A recent theory, the one apparently most acceptable at this time, attributes to the ultraviolet ray a marked influence in vitamin production with particular reference to vitamin D. According to the theory, all living cells, including skin cells, contain an alcohol, *cholesterol*. This cholesterol has the property of absorbing ultraviolet light, which absorption, in turn, leads to changes within the cell tending toward the production of vitamin D. The vitamin D is absorbed by the circulation and

produces, in consequence, the beneficial results characteristic of this vitamin.

It is necessary to state that chemical transformation does not seem to take place in connection with pure cholesterol. The activity of the chemical reaction seems to depend on the presence of an impurity—ergosterol. Ergosterol is found in yeast, mushrooms, other fungi and, most abundantly, in ergot. It is said that ergosterol is two thousand times as potent as cholesterol and one hundred thousand times more active than cod-liver oil. Recently, irradiated ergosterol has received considerable attention in the treatment of rickets.

Professor Dixon has advanced the interesting theory that fluorescent substances in the skin, as quinoidine, when irradiated can become bactericidal and can stimulate nerve endings. This sensory stimulation outlines the blood vessels in the skin and subcutaneous tissues. The vascular changes in conjunction with some indefinite substance generated locally and absorbed, are, according to this theory, responsible for the physiological effects.

In connection with this theory it may be well to state that Tappeiner and others have shown that light greatly intensifies the toxicity of certain acridine derivatives to microorganisms. Peacock believed that fluorescence of the skin was protective phenomena.

McKenzie and King believe that therapeutic action of the ultraviolet radiation takes place upon and through the nervous system. They believe that immediate *nerve stimulation*, in sensory nerves, is followed by stimulation of the nerve control apparatus of the endocrine organs. The reaction of the endocrine organs, in turn, will tend to regulate and enhance metabolism.

There are others also who believe that through the action of the rays upon the nerve endings, the sympathetic nervous system through reflex action is influenced to modify the physiological activities of the body.

Many believe that the ultraviolet rays are absorbed by the blood, stored in some way of which we have no knowledge, and distributed to the tissues according to some plan of which, likewise, we have no knowledge.

General Action

Study of the general and special physiological changes consequent on the use of heliotherapy has brought forth interesting information. Exposure to natural sunlight results

in a feeling of warmth, well-being, exhilaration and buoyancy. Mental activity is enhanced and fatigue and depression tend to disappear. All are agreed on these general facts. Most are agreed also that suitable exposure to artificial sunlight in the form of either the carbon arc lamp or the mercury vapor arc is accompanied by a sense of well-being and physical betterment.

We will take up *seriatim* the physiological changes resultant on the use of light, and attempt, perhaps, to harmonize some of these changes with the above mentioned theories.

Sunlight exercises a profoundly beneficial influence on metabolism which, as a whole, is stimulated. In the matter of calcium and phosphorus metabolism, the influence is especially favorable. The individual deprived of ultraviolet light is soon affected with metabolic imbalance and suffers from calcium and phosphorus starvation.

As a result of such mineral imbalance, in the case of the child, for instance, growth of the bones is seriously interfered with and rickets results. Adults also show many functional and pathological aberrations if the calcium metabolism is interfered with. One of the results of calcium deficiency is the change in hydrogen-ion concentration of the blood. This change in hydrogen-ion concentration leads to acidosis. In children, the gastrointestinal disturbances, and nervous disturbances, as tetany, are frequently due to acidosis following mineral imbalance. In adults, also, calcium starvation and mineral imbalance frequently lead to various disorders, gastrointestinal, nervous, respiratory, etc.

The increase in phosphorus and calcium metabolism is due to the increased absorption and deposition of these salts without there being any definite increase manifested in the blood stream itself. It is supposed by some that vitamin D, already referred to as being derived from ergosterol of the skin, is operative in promoting this better absorption of calcium and phosphorus from the intestinal tract.

The action of ultraviolet ray and cod-liver oil relative to the calcium and phosphorus metabolism is somewhat similar. It may, at first, be rather puzzling to try to work out this analogy. Is the action of cod-liver oil due to the fact that storage of ultraviolet rays had, in some way, occurred in the liver of

the cod? The theory is interesting. The cod, we know, lives on squid and the squid, in turn, lives on the plankton which floats about on the surface of the sea, exposed continuously to the actinic ray.

It may not be out of place to say a word concerning the function of the parathyroid gland. We know that the parathyroid gland has as at least part of its function, the control of calcium metabolism. Complete removal of the parathyroids leads to tetany which, in turn, is controlled by intravenous injections of calcium lactate.

In considering then the nature of the therapeutic reaction resultant on the use of both cod-liver oil and the actinic ray, it is necessary to bear in mind this function of the parathyroid gland. Is the improvement in the calcium and phosphorus metabolism, in both instances, due to regulation of the parathyroid hormone through the medium of the ultraviolet ray?

Some authorities claim that heliotherapy tends toward a speeding up of generalized endocrine function. The effect seems to be particularly prominent in the case of the thyroid and sex glands. The fact that menstruation appears earlier in girls in sunny climates is adverted to in attempting to establish the relationship of sun therapy to endocrine function.

Revilliod reported successful treatment of myxedematous children by daily sun baths without the use of thyroid extract. The same authority mentions the report of Dupasquier of Lyons to the effect that in a certain town in the mountains of Duaphigny, cases of endemic goiter occurred in almost every house on the shady side of the street while no cases of the condition were found on the sunny side.

Hasselbach noted a decrease in the size of goiters in a series of women treated by the quartz light. Other observers, including Grant and Gates of the Rockefeller Institute, have found that the weights of the endocrine glands, including the testes, increase during a period of irradiation. The parathyroids, in particular, show marked increase, the percentage varying from 14.1 to an increase of 51.1.

Saleeby and other observers have found an increase in the iron content of the blood and the iodine content of the thyroid after irradiation. This action, perhaps, may be due to the general improvement of endocrine function.

In addition to increase in the calcium con-

tent, other physiological changes in the blood are noted. The coagulation time of the blood is decreased, due undoubtedly to the increase in calcium content. This is of importance in preoperative cases or in cases subject to hemorrhage.

As regards the cellular content, there is a tendency to an increase of the reds and, according to some authorities, the lymphocytes also are increased. Some authorities emphasize the importance of this lymphocytosis.

Janet Clark states that possibly the lymphocyte-forming organs are stimulated to greater activity by some photochemical change produced by ultraviolet light. The formation of blood-platelets also seems to be stimulated by light treatment. Sooy reports that the blood-platelets may be increased to a million and a half through artificial radiation. Occurrence of leukocytosis is reported by most authorities.

In 1920, Baumann reported an unusual increase in the leukocytes. Gauvain also had noted a leukocytosis following the use of heliotherapy. Similar findings seem to prevail relative to the hemoglobin and the red count, Reidel and others found an increase in the hemoglobin. Frequently there is, at first, a drop in the leukocyte count, followed after a few hours by an increase. This increase continues for several days after which a gradual decrease is noted.

Cod-liver oil and cholesterol, as already discussed, provoke the question of relationship, if any, between *vitamins and light*. Is a vitamin actually formed by irradiation of cholesterol? What is the role of light in the etiology of the deficiency diseases?

Young rats fed on diets deficient in vitamin A and antirachitic substances are prone to develop rickets, xerophthalmia, infections of the ears, and cease to grow. Exposure to ultraviolet rays prevents the occurrence of rickets in such animals. Sheets and Fund found that in the case of rats fed on a diet deficient in vitamin A rickets was prevented by ultraviolet treatment. The rats grew at the normal rate but xerophthalmia developed notwithstanding the violet ray.

Steenbock and Nelson find that aerated cod-liver oil and ultraviolet rays, in other words antirachitic agents, will restore growth in rats who have been nourished on a diet deficient in fat-soluble vitamin. The anti-rachitic

agents, however, will not prevent the occurrence of ophthalmia.

Undoubtedly the actinic ray and the vitamin are closely bound up in the case of rickets. The relationship, however, does not seem to prevail in the case of other deficiency diseases. Rickets in the tropics is practically non-existent and its non-existence is probably due to the fact that in this region there is a continuous supply of intense, ultraviolet radiation. Scurvy, beri-beri and other diseases, however, may occur in the presence of adequate sunlight. In addition to its effect on vitamin D, ultraviolet radiation is supposed to enhance the action of the fat-soluble vitamin A.

The question of *food irradiation*, opened up for research in recent years, is of interest. It has been clearly demonstrated that many different substances subjected to ultraviolet radiation assume anti-rachitic qualities in which they were deficient prior to the radiation. Flour, wheat, meat, eggs, milk, and fats and oils, such as lard, cottonseed oil, linseed oil, and olive oil, have been abundantly activated with antirachitic substance.

It is of interest to note that cholesterol, which we have already discussed, being present in almost every living cell, is of course a constituent of most all food stuffs. Cholesterol itself, in the pure crystalline form, can be rendered definitely antirachitic through the medium of the mercury vapor lamp. The cholesterol, however, in the dry state quickly loses its antirachitic qualities. The degree of irradiation seems to have significance as regards the degree or amount of antirachitic substances produced. The antirachitic properties induced by irradiation may be diminished, or indeed, completely destroyed or eliminated by overdosage.

As regards the nature of the chemical transformation, it is necessary to admit that considerable doubt still remains. Hess has shown that the ultraviolet radiation changes the chemical composition of cholesterol, as is shown, for instance, by a definitely altered spectrum. The cholesterol in the skin being particularly rich, as indicated, is, according to one of the theories mentioned, chemically altered, and the altered product, or some of its constituents, is taken up by the sub-epidermal capillaries. Whether vitamin D is one of the end products of the chemical change, formed *in loco*, or whether vitamin D is later

formed in the tissues as an expression of complicated tissue reaction, is another question.

Bactericidal Action

Bactericidal action of the actinic rays was definitely demonstrated by Robert Koch in 1890. Koch showed that the tubercle bacilli readily succumb to light. Bacilli, spread in thin films, are killed by direct sunlight in ten minutes. The chief bactericidal effect, as already intimated, is allocated to the short waves of the far ultraviolet segment. The light affects not only the bacteria, but also their spores, products and secretions. The irradiated tuberculin apparently loses its toxicity and is powerless to induce intra-dermal reaction. Toxins of diphtheria and tetanus are similarly affected. Bacteria of all kinds are rather uniformly affected by ultraviolet rays. Bacterial spores are more susceptible to ultraviolet light than either to heat or chemicals. It must be borne in mind, however, that if a lethal dose is not administered, the bacterial life may be stimulated.

Mentality

It is hardly necessary to report the experiments in order to demonstrate that sunshine, either natural or artificial, has an invigorating effect on the mentality. Every one, child and adult, feels better in the sunshine. Even animals and birds show quite clearly their reaction of joyousness and well-being towards solar radiation. Tests and experiments made, however, confirm the general observation. Tests made, for instance, in special schools for the physically defective children in England, showed that the children who had been subjected to irradiation displayed marked mental superiority as compared with those who did not have the advantage of light treatment. It was found that the children at the Alton Institution, where heliotherapy was practiced, were mentally nearly a year in advance of children of similar age in a London institution, who had not received treatment. Gauvain, in reporting the results, adds a rather interesting note: "We advance the suggestion, which further investigation may confirm or disprove, that ultraviolet light, shown to be an important factor in effecting tissue change, may thus improve the nutrition of the gray matter of the brain, and in this way increase the output of mental activity which we claim follows judicious exposure to light."

Natural Versus Artificial Sunshine

Before proceeding to the discussion of the indications and treatment, it may be well to spend a few moments in the consideration of the relative advantages of natural and artificial sunshine. In comparing artificial and natural sun therapy, we are really attempting to compare two different things. For instance, in the case of natural sun therapy, we have, in addition to the factor of light, other adjunct factors of treatment, which are of importance. We have added to the influence of the light, perhaps a healthful mountain or seaside climate, an institution where rest, hygiene and daily air baths as well as sun baths are essential parts of the routine. The influence of currents of invigorating air on the skin and musculature is well known.

The combination of outdoor life and direct, clear sunshine in a good environment, is most desirable. This combination, however, is not always, nor even frequently, available. In the future, no doubt, institutions which provide facilities for natural heliotherapy under ideal circumstances will be more numerous.

Now to consider another aspect of the question—heliotherapy under unfavorable circumstances. In cities, low lying countries, foggy countries, valleys and such environments, natural heliotherapy may prove very unsatisfactory. The actinic ray is shut out by clouds, dust, smoke and other atmospheric impurities. Under such conditions, of course, artificial heliotherapy is desirable, perhaps even the only method available. Even in conjunction with natural heliotherapy under ideal circumstances, artificial heliotherapy, in addition, for certain conditions, local or otherwise, may be indicated. Both types of therapy have their indications and their limitations, and the open-minded physician keeps this fact in mind and is willing to avail himself to the best of his ability of both influences. For natural heliotherapy the sunlight in the mountains is, of course, preferable; next in preference comes sunlight at the seaside; then sunlight in the foothills, then sunlight in the plains. The sunlight in the cities is, of course, for obvious reasons, extremely unsatisfactory.

The special indications as calling for light from different sources has not yet been sufficiently clearly defined. In skin tuberculosis, possibly the shorter ultraviolet rays of the mercury quartz lights are most helpful. In

tetanus, rickets and similar conditions, either the mercury arc or the high amperage carbon arc may be suitable. For tuberculosis, pulmonary and otherwise, both types of treatment, treatment with the mercury lamp and treatment with the carbon arc lamp, have been followed with marked success in certain groups of cases. Some favor the use of the carbon arc for most conditions, owing to the fact that the carbon arc most closely approximates the composition of the natural sunlight. The advocates of mercury quartz lamps claim that the ultraviolet ray is the therapeutic and efficient part of the spectrum, and consequently, that the mercury quartz lamp, which is richest in the ultraviolet ray, is the logical apparatus to be used.

In the case of artificial versus natural sunlight, the physician must decide for himself on the merits of the individual case. Ideally, both the carbon arc lamp and the mercury vapor should be available for service. For convenience in treating groups, carbon arc units, may be desirable. In Chicago, as already explained, we overcame this problem of mass treatment by installation of mercury arc apparatus for mass treatment.

Each individual condition, as seen by the physician, may call for certain specific treatment, may demand more or less ultraviolet rays, or more or less infra-red rays. It must be remembered that the composition varies greatly, depending on the source; that as regards the ultraviolet rays, for instance, the mercury vapor lamp contains about 22 per cent ultraviolet, the natural sunlight about 1 or 2 per cent ultraviolet, and the ordinary carbon arc lamp about 7 per cent ultraviolet.

Indications and Contra-Indications

The enthusiastic sun worshiper sees in every condition an indication for sun treatment. He claims that sunshine is one of the few things that can do no harm. In this, of course, he is wrong. Sunshine, either natural or artificial, taken in overdosage, may do considerable damage to the well and to the sick. Excess in anything is undesirable. "A little wine for your stomach's sake," is probably good advice. Too much wine is indubitably bad. Too much food, too much exercise, too much sleep are, of course, bad; and likewise, too much sunshine is bad. Our study of the composition of sunlight must have convinced us that certain rays are dangerous, as well as

curative. A dose of arsenic may be advisable for certain conditions; a large dose of arsenic is fatal.

Probably the rather slow advance that heliotherapy is making, is due to the fact that the dangerous properties of sunshine are now sufficiently appreciated. The harm done by ignorant or careless sun treatment measures impedes the progress of true heliotherapeutic science.

General Indications

In a paper of this length, it is impossible to give more than a cursory summary of the general indications for sunlight treatment.

A. DERANGED METABOLISM. Deficiency diseases, particularly rickets, associated with deranged metabolism, are frequently greatly benefited by heliotherapy. Sub-thyroid conditions and parathyroid dysfunction, may be definitely corrected by the use of sunlight.

B. BLOOD DYSCRASIA. Owing to the stimulating action of sunlight on the blood, ultraviolet treatment often meets with success in anemias of various types. It would seem that ultraviolet therapy might be indicated in hemophilia and diseases characterized frequently by diminution of the blood platelets and calcium deficiency. To date, however, there are no very conclusive reports in this respect.

C. GASTROINTESTINAL SYSTEM. There are many gastrointestinal conditions in which ultraviolet irradiation has proved beneficial. It has been found effective in hyperacidity, in gastroenteric disturbances and in chronic gastritis. The irradiation of the abdomen is frequently helpful in the diffuse abdominal pains resulting from colitis, enteroptosis and similar conditions. Ultraviolet rays are not infrequently helpful in relieving the pain and discomfort due to gastric ulcer. In chronic gall bladder and liver conditions, the use of the ultraviolet ray is also said to be beneficial. In the treatment of hemorrhoids, some workers have found local applications effective.

Local Conditions

Sunlight is prescribed with very great success in an extremely large number of local conditions, including acne, acne keloid, chemical burns, burns, scalds, impetigo, psoriasis, eczema, x-ray burns, pleuritis, tonsil infections, acute and chronic local abscesses, rhinopharyngeal inflammations, boils, furunculosis, carbuncles, dermatitis, venenata, erysipelas,

herpes, lichen, planus, nevus, pernio, pityriasis, rhinophyma, tinea versicolor, and ulcers.

Gynecologists have had favorable results from heliotherapy in endocrine disorders, particularly those referable to dysfunction of the sexual organs. The rays have been found effective in such conditions as metritis and ovaritis, dysmenorrhea, amenorrhea and leukorrhea.

Bronchial asthma and hay fever have of recent years been treated with some success by heliotherapy. The indications for heliotherapy in tuberculosis will be discussed separately.

Indefinite disorders of the nervous system are frequently quite amenable to heliotherapy. Many individuals with lowered endocrine function and the apparent subnormal vitality, are greatly benefited.

Neurasthenia, psychalia, insomnia, melancholia and similar conditions frequently show very appreciable progress after even a short course of treatment. Diffuse and definite headaches, sciatica, neuritis, and other nervous inflammations, lumbago and other forms of muscular rheumatism, are frequently improved.

Rickets, as an indication, has already been considered. In chronic articular rheumatic conditions, local applications properly administered seem to be of benefit. Fractures heal more readily under the influence of the rays.

Certain diseases of the eye and ear are amenable to ultraviolet treatment. Acute and chronic nasal conditions and inflammations are frequently benefited by local treatment.

Indications in Tuberculosis

All forms of tuberculosis and the various types of lupus are, as a rule, amenable to ultraviolet treatment.

The success which Finsen met with in the treatment of these conditions, may be duplicated today by the physician who is willing to exercise patience and judgment. In the treatment of lupus and other skin tuberculides, either the carbon arc or the mercury vapor lamp may be used. General as well as local treatments are desirable. Local irradiation is usually given by the compressor method. A normal dose is first given, then slowly increased. In severe cases a preliminary x-ray treatment may be given.

Rollier has had very great success in the treatment of tuberculosis of the bones and

joints. Workers with artificial sunlight have also met with success. In this condition, as indeed in all forms of tuberculosis, it is necessary to pay the greatest attention to the general condition. The traditional triad—rest, fresh air and food, still have their place. We can not neglect the general health of the patient, allow him to live an abnormal life in an unhygienic environment, and expect success from unaided heliotherapy.

Every patient suffering from tuberculosis should be closely supervised, should have absolute rest in bed, as indicated, should have a two-hour or four-hour temperature in febrile cases, and should, in addition, to heliotherapy, be given every medical and hygienic advantage that is available to modern scientific phthisiotherapy. This routine should prevail whether the patient is undergoing treatment in a mountain institution, in a city hospital or sanatorium.

A patient who is to receive treatment by means of natural sunlight in an institution, either in the mountains or at the seashore, should, during the first few days, remain indoors and in bed. During this time his condition can be suitably evaluated, the history conscientiously taken, and a tentative system of dosage considered. The patient is gradually taken out of doors, and the process of acclimatization commenced. Acclimatization is particularly necessary in the case of institutions at any considerable altitude.

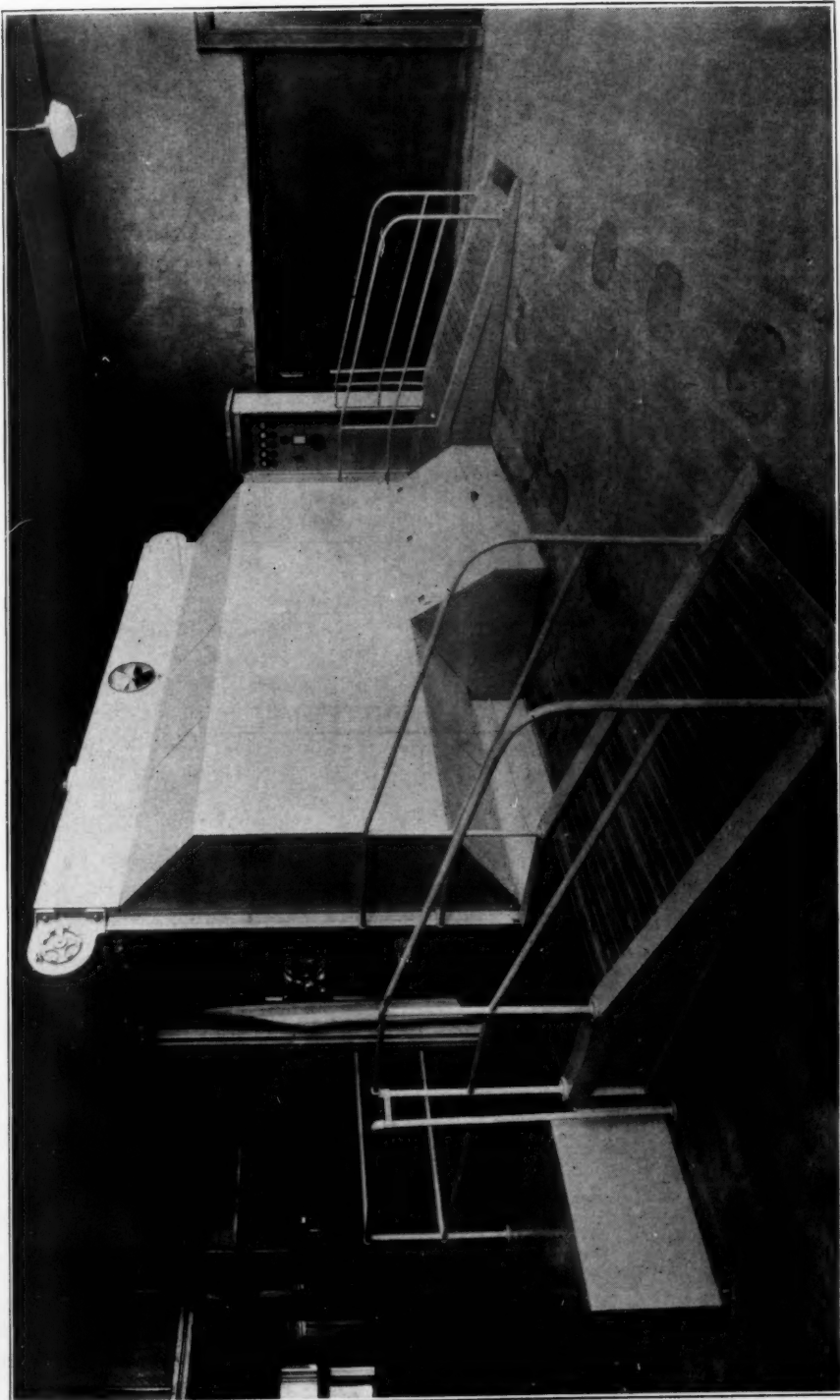
Individualization is necessary for dosage. Each case must be studied by itself, the reactions carefully noted, and the dosage increased or decreased according to indications. The diagram suggested by Rollier* is submitted on page below.

The irradiations are repeated three times, at intervals of ten minutes each. On the second day, as the chart shows, the legs are exposed as well as the feet, but only for five minutes at a time.

The exposures may be prolonged or curtailed, depending on the individual case, on the progress of pigmentation, and the general conditions.

As soon as pigmentation is complete, the patient can be safely exposed to radiation for several hours. Rollier recommends an average of three or four hours in winter, and two

* Heliotherapy, A. Rollier, M.D., p. 41. Oxford University Press.



View of machine constructed and installed at the Spalding School for Crippled Children, Chicago.

or three hours in summer. It is extremely essential to follow some such routine as this. It is well to insolate the feet first, as in this way the patient can not experience a severe reaction. The gradual increase in exposed surface will allow the physicians to form a good judgment as to the sensitivity of the patient.

During the exposure, the head and neck are protected by a white linen hat, with a wide brim. Rollier advises that the region of the heart be covered with a white cloth, in the case of cardiac patients.

Severe reaction should be avoided. Over-enthusiasm should be curbed. The patient should not be allowed to become fatigued, dizzy or nervous from over-exertion.

The local action of direct sunlight is bacteriocidal, analgesic and curative. The local dosage must also be carefully and conscientiously regulated, and each case must be considered and treated on its individual merits. In estimating the dosage and foreshadowing the reaction, it is necessary to take into consideration not only the character and extent of the local lesion, but also any complication present, such as pulmonary tuberculosis.

In tuberculous peritonitis very short exposures are sufficient. These cases are, as Rollier emphasizes, to receive the sun cure, as it were, with a "drop bottle." Extreme care is also necessary in pelvic and bladder tuberculosis. In periostitis and synovitis, and joint troubles with fungus formation under ordinary treatment, reactions are not to be feared owing to the presence of comparatively few blood vessels. In some cases local irradiation and the general sun bath are administered simultaneously. In other instances, when it is desirable to curtail the local application, suitable screening may be used to protect the lesion and the general sun bath may be continued for the desired time.

Rollier has met with very great success in his work at Leysin. He says concerning heliotherapy: "I feel, just as I have been claiming, that this method is capable of curing surgical tuberculosis in all its forms, in all cases, however bad, and I shall never weary of repeating the basic principle of this treatment, that the conception of surgical tuberculosis as a local disease, which must only be treated locally, can not be maintained any longer. Surgical

tuberculosis is a general disease, and as such it calls for general treatment."

For obvious reasons, Rollier has discarded plaster-of-Paris braces and casts. He replaces such casts by immobilizing suspension and extension appliances, which he advises should be as simple as possible. Space does not permit a description of the interesting orthopedic technic practiced. Those interested are referred to Rollier's book, "Heliotherapy".

Results of Natural Sunlight on Bone, Joint and Peritoneal Tuberculosis

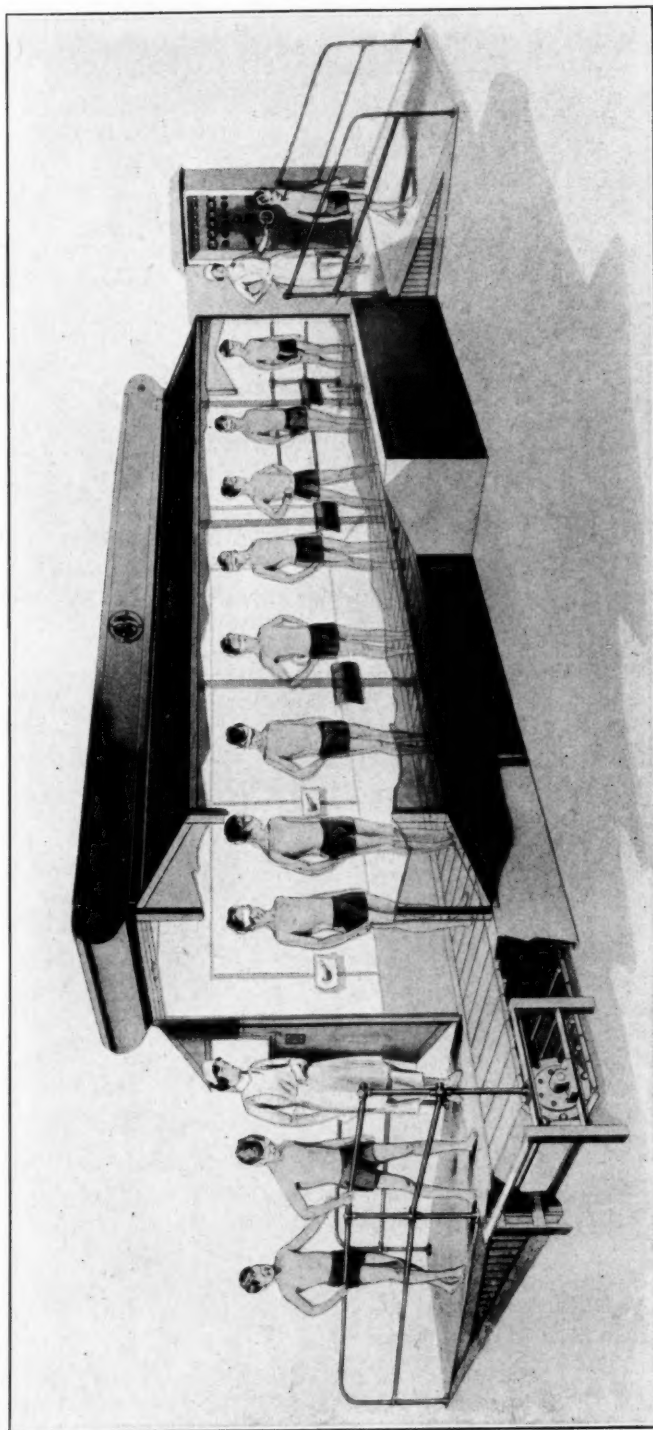
The results of natural sunlight in such institutions as Leysin, Perrysburg and Cragmor are quite amazing. Even in severe cases improvement in the general condition and the local lesion is extraordinary.

The general condition shows improvement almost from the first. A spirit of optimism appears. The psychic influence of sunlight in a mountain climate is remarkable. The psyche is elevated to a degree which is not reachable through autosuggestion alone. Bed-ridden patients, who have been bed-ridden for years perhaps, are cheerful and happy.

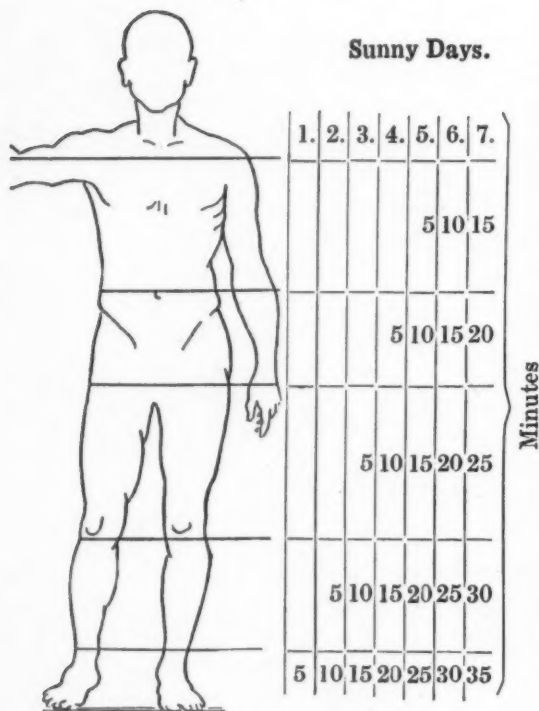
There seems to be something better than mere medicine in the sunshine. It is useless to say that the elasticity and buoyancy of spirits is due to environment, institutional morale or Coueism. The euphoria and sense of well-being are the result of something which has become part of the psyche rather than something which merely affects the psyche. Sunshine appears to be a medicine for the mind that metamorphoses the mind and mental attitude during the process of medication.

There is increase in appetite, and temperature, if present, tends gradually to disappear. The blood condition improves as is demonstrated by an increased hemoglobin and a raised cell count. Pigmentation depending on the individual and exposure gradually develops; the tone of the skin and musculature becomes firm.

The improvement in the local condition is usually equally satisfactory. The swelling in the diseased joints gradually disappears; the discharge becomes less, pain and tenderness become less marked and immobility is improved. The atrophy which is resultant on long immobilization tends to disappear and there is less tendency to ankylosis as the le-



Artist's sketch showing the Goldberger Ultraviolet Unit at the Spaulding School for Crippled Children, Chicago. Front of apparatus cut away to illustrate operation.



Diagrammatic Course of Sun Cure.

According to the individual reaction, the daily dose may be doubled or tripled.

The dorsal surface of the body is treated in a similar manner wherever permitted by localization.

The insolation continues progressively beyond the seventh day, so that a maximum duration of two to four hours is reached.

After the third week one may proceed to a full sun bath. Neck and head lesions may be exposed to the sun only after a previous preparatory irradiation of the rest of the body.

sion heals. The spread of suppuration is impeded.

With proper care and conscientious supervision, the results obtained by natural heliotherapy in tuberculous peritonitis are quite encouraging. The exudative form of peritonitis responds especially well. Large exudates, particularly, disappear after five or six weeks. The disappearance of the exudates is contemporaneous with general improvement, increased appetite and a gain in weight. The fibro-adhesive form also responds well. The thickened, doughy mass in the abdomen gradually disappears; the pain and discomfort become less and finally disappear.

Intestinal tuberculosis, including tuberculous tumors in the ileocecal region, improve markedly. The ileocecal tumor rapidly disappears and the intestinal symptoms, flatulence, discomfort after eating, pain and diarrhea also disappear.

In tuberculous peritonitis, particularly, the greatest caution is necessary in the matter of exposure. Each case must be studied individually and even the slightest reaction suitably evaluated. Often it is necessary to be content with irradiation of the feet and legs for a period of two or three weeks or more. Exposure of the abdomen should be practiced very cautiously and at first, only for a few

minutes at a time. Over-exposure may increase pain and tenderness and work considerable harm. Both local treatments and the general sun bath, after the preliminary stage of caution, are advisable.

In Chicago, glandular tuberculosis is, at present, much less of a problem than it was in former years. Owing to the fact that all milk in Chicago is pasteurized, the incidence of glandular tuberculosis has greatly decreased. A few years ago, in 1925, an additional ordinance was put through which makes it requisite that all milk coming into Chicago be derived from tuberculin tested herds. With this double safeguard, we naturally see very little glandular tuberculosis in Chicago.

The rarity of glandular tuberculosis in Chicago today is in marked contrast to the condition that prevailed a couple of decades ago when cervical adenitis was an extremely common condition and surgery the fashion. We think that extirpation of tuberculous glands, today, is a comparatively rare operation in our hospitals. Even if glandular tuberculosis were as common today as it was in former years, it seems rather certain that surgery would play a role of comparative insignificance in the treatment.

The glands serve a useful and necessary

role in acting as filters against infection. Their removal, except in severe cases, would not seem to be indicated. Their removal would seem particularly inadvisable in view of the fact that, as has already been shown, excellent results may be obtained by heliotherapy at the expense of a little care and patience. Even good surgery implies a scar that is, to some extent, disfiguring. In the case without sinus formation or ulceration submitted to heliotherapy, this scarring may be avoided. Complete absorption of the glandular swelling is brought about by heliotherapy. The deep as well as the superficial glands are affected and even the glands affected with a severe periadenitis undergo finally, complete absorption. Tracheobronchial adenitis also responds quite well.

The technic of treatment in glandular adenitis is comparatively simple. The patients are exposed for an hour or two every morning. The exposure is gradually increased and, finally, the neck is allowed to remain bare while the patients take their usual recreation. During the night, Rollier advises that a small piece of wire netting be placed over the lesion. In this way an uninterrupted supply of air is admitted to the wound.

Heliotherapy should be used with great caution in the treatment of pulmonary tuberculosis. In the active tuberculous process of the exudative type particularly, great harm can be and is very frequently done. In cases of fibroid tuberculosis with very little or no exudate, heliotherapy has been used with some success but here too only with very great caution.

Sunlight treatment, of course, should not take the place of the usual routine treatment—rest, fresh air, diet and measures such as pneumothorax, phrenicoexeresis and thoracoplasty.

Certain conditions are considered to contraindicate any appreciable measure of heliotherapy. The presence of high or continued fever, marked activity in the lesion, hemorrhage, advanced cardiovascular disease, and individual susceptibility are contra-indications.

As regards hemorrhage, heliotherapy if used in pulmonary tuberculosis may predispose to this manifestation and for this reason, is not advised.

In cases with serious cardiac complications, similarly, if used at all, the dosage, at first,

should be extremely small and carefully controlled. If depression rather than exhilaration follows in an individual case, irrespective of whether or not the disease is active, extreme caution must be exercised relative to continuance of the treatment.

Indications

1. Pretuberculous individuals, particularly contacts—those who have been exposed to intimate contact with an open case—are frequently benefited by tonic treatment either with natural or artificial heliotherapy.

2. Early afebrile cases. The early afebrile or slightly febrile individual of the fibroid type, with a sluggish apical lesion, is occasionally benefited.

3. Chronic fibroid tuberculosis. Some cases of chronic fibroid tuberculosis, which seem to be definitely blocked at a certain stage in their progress, are given the necessary added impetus toward improvement. Patients who have remained for years in a more or less stationary condition, seem to be given, by heliotherapy, the slight added lift or pull which is necessary to get them ahead.

4. Pleural tuberculosis. Pleural tuberculosis, either serous or dry, reacts well either to artificial light therapy or solar exposure.

5. Tuberculous empyema with sinus. This condition may be frequently helped considerably by irradiation. The sinuses seem to be helped greatly by the local treatment.

Artificial Heliotherapy in Tuberculosis

Most authorities advise a combination of general and local exposure for laryngeal tuberculosis. A few are content with general irradiation alone. Local exposure is carried out by means of reflected light or by direct irradiation through means of fused quartz applicators attached to the Kromayer water-cooled mercury quartz lamp.

Mayer, in his series, practiced local irradiation twice a week. Using reflectors, the period of exposure was gradually increased from two minutes to forty-five minutes. A similar plan of exposure was followed with the use of a quartz applicator attached to the Kromayer lamp. With the lamp permitting direct exposure of the larynx, irradiation was gradually increased from thirty seconds to fifteen minutes, the increase being about one to two minutes at each exposure. We might also mention the unique device of reflectors which

was developed by Dr. Alexius Forster of the Cragmor Sanatorium. This apparatus has shown remarkable results in the treatment of laryngeal tuberculosis through the reflection of sunlight by these mirrors.

Direct exposure to ultraviolet rays has been practiced by some without apparent harm to the eye. Others recommend that ultraviolet rays be applied through light filters or through slightly closed lids. Various forms of con-

Tuberculosis Sanitarium, we use, for the most part, the mercury quartz lamp. The indications and contra-indications, as already given in the case of natural heliotherapy, apply in the matter of artificial sun treatment.

Each case must be studied individually. Each individual case must be carefully supervised and the patient watched for reaction. It is not possible to give any plan or scheme covering every patient. Tuberculosis is pro-



Carbon arc unit recently developed by Dr. Brian O'Brien of the J. N. Adam Memorial Hospital, Perrysburg, New York.

conjunctivitis, trachoma, corneal ulcers, etc., have been treated by some with apparent success.

Artificial heliotherapy seems quite effective in treatment of tuberculosis of the glands. The dosage must, of course, be carefully regulated. General irradiation, as well as local treatments, is advisable.

In this climate, especially during the winter season, artificial heliotherapy is frequently essential in the treatment of pulmonary tuberculosis. In our institution, the Municipal

tean in its symptomatology and as no two cases are alike, it is manifestly impossible even to attempt a schematic plan for sun treatment. It is much better policy to start with extremely small doses and gradually increase. Those who wish may use the modification of the Rollier tabulation, already given.

We offer also for consideration, a scheme suggested by McKenzie and King in their book, *Practical Ultraviolet Light Therapy*.

For the patient coming to the office, for whom perhaps it may be convenient to disrobe at each visit, this plan may be advisable, starting as it does with the upper extremities rather than with the feet.

Scheme for Irradiation of Tuberculous Cases

Figures represent minutes. Lamp at 3 feet distance.

Date	Face	R. Arm	L. Arm	R. Leg	L. Leg	Chest	Abd.	Back	Butt.
1st day.....	1	1	---	---	---	---	---	---	---
2nd day.....	2	1	---	---	---	---	---	---	---
3rd day.....	3	2	1	---	---	---	---	---	---
4th day.....	4	3	2	1	---	---	---	---	---
5th day.....	5	4	3	2	1	---	---	---	---
6th day.....	5	5	4	3	2	1	---	---	---
7th day.....	5	5	5	4	3	2	1	---	---
8th day.....	5	5	5	5	4	3	2	1	---
9th day.....	5	5	5	5	5	4	3	2	1
10th day.....	5	5	5	5	5	5	4	3	2
11th day.....	5	5	5	5	5	5	5	4	3
12th day.....	5	5	5	5	5	5	5	5	4
13th day.....	5	5	5	5	5	5	5	5	5

On the 14th to 21st day the anterior aspect is irradiated for five minutes. From the 21st to 28th day the posterior aspect is irradiated for five minutes. On the 28th to 35th day the anterior aspect is irradiated, and so on.

It must be recognized, however, that no plan and no scheme can take the place of conscientious study and individual judgment. Artificial sunlight in tuberculosis should be given by one who understands light therapy and who understands tuberculosis. The physician who practices this therapy should not allow an office assistant or a nurse to give routine, unsupervised treatment.

This, unfortunately, is only too often the case, and the neglect in care and individualization has been a factor in bringing the science of heliotherapy into some disrepute. The writer has known of a physician who allowed his attending nurse to treat far-advanced, active cases of tuberculosis with the mercury quartz lamp. The nurse, with no knowledge whatever of light therapy, gave each patient a standard dose, irrespective of the activity of the lesion, temperature or the general condition.

The writer has attempted to review briefly some of the outstanding features of heliotherapy as it is practiced and understood today. Sun treatment, undoubtedly, has an important place in the management of tuberculosis. Unfortunately, as a measure, it has been exploited without sufficient scientific accuracy. Too much enthusiasm on the one hand has led to extravagant assertion and unfounded optimism. Undue skepticism, on the other hand,

has attempted to deny any appreciable healing value to heliotherapy.

The middle road, as is usually the case, is the safe and rational way. Sunshine therapy is not a fad. It is a mode of treatment based on tradition and on proved scientific fact. Undoubtedly, in another decade or so, we shall see the science of heliotherapy more definitely standardized and more generally accepted and applied.

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THE VALUE OF ULTRAVIOLET RADIATION IN EXTRAPULMONARY TUBERCULOSIS *

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CHICAGO, ILL.

The physiologic action of light on living material is primarily due to photochemical changes which results following absorption. This is in accordance with the law enunciated by von Grothaus that chemical action can only take place after energy has been absorbed. Modern science has demonstrated that photochemical processes are far more active in both the organic and inorganic realms than is generally supposed. Living material is indisputably dependent upon the energy in its environment. Heat, light and ultraviolet radiation are the sources from which it has always drawn its major sustenance. The inorganic world is likewise governed by the same laws and the same environment. All of our vital activities, such as growth, differentiation and metabolic processes are dependent upon the beneficent influence of our central source of energy, namely the sun.

It may still be a mooted question in certain quarters whether life arose from the warming influence of the sun's rays, but the evidence is overwhelming that life and health has been dependent for its existence upon this source of energy. Throughout all ages mankind has recognized its value as a healing agent. Its value has been extolled by the ancients in our profession; but only in the past several decades has any attempt been made to interpret the action of heliotherapy upon a scientific basis. The medical profession has on more than one occasion acknowledged its indebtedness to the pioneer work of Finsen, Dorno, Bernhard, and Rollier. It is safe to say that no modern, intelligent physician denies the curative possibilities of natural or artificial sunshine in certain selected cases of surgical tuberculosis.

The treatment of surgical tuberculosis has been materially modified from the time that Finsen demonstrated the cure of skin tuberculosis by the Finsen or carbon arc lamp. Bernhard and Rollier have demonstrated that bone, joint and other extrapulmonary tubercular conditions can be favorably influenced

when sunshine is intelligently administered. At the present time helio- and phototherapy are practiced in high and low altitudes; carbon and mercury quartz therapy is utilized wisely and foolishly, commercially and scientifically, by physicians and by lay people. The pendulum of enthusiasm has in many instances swung beyond the reach of conservative therapy. Abuses of this valuable measure may be expected for it is a spectacular agency that lends itself to ready exploitation.

While my purpose here is to expatiate on the value of heliotherapy. I cannot forego the opportunity to warn the profession that much harm may result in the wholesale use of this measure by bathhouses, clubs, beauty parlors, and by people uninstructed in its use or its indications. It is a double-edged instrument. People who are photosensitive or suffering from nephritis, diabetes and other organic disturbances may greatly injure themselves by its indiscriminate use. Phototherapy, just as drug therapy, should be administered under intelligent supervision and, preferably, by a physician.

Heliotherapy is admittedly the superior of all measures in the treatment of extrapulmonary tubercular lesions. The patient is not only benefited by the tonic effect of the solar radiation, but he is also largely affected by the air and climate associated in the treatment. Climate and air are no small contributing factors in the end results obtained by heliotherapists. Indeed, modern phototherapy initiates the patient by first adapting him to his new environment by a series of fractional exposures to air, sky-shine and lastly to sunshine. In this manner the body becomes adjusted to the unusual changes. Bernhard¹, Rollier², and Kisch³ at first fractionally irradiate the entire body of the patient, with exception of the affected part, which is screened out until the patient has been thoroughly irradiated and fairly pigmented. Finally, the affected part is gradually exposed and eventually blended with the treatment of the whole body. Depression of metabolism, nervousness and shock is thus

* Read before the Chicago Tuberculosis Society, May, 1929.

minimized, and a host of favorable physiologic changes follow.

The physical transformation is gradual, and, in the end, it is decidedly satisfactory. The skin of the patient gradually assumes a bronze-like appearance. The skin which at first is usually coarsely dry, or covered with large bead-like perspiration, becomes soft, firm and oily to touch. The scaly, wrinkled appearance gives way to dimpling when pinched. Muscle spasms and pain disappear without the aid of drugs, and the body gradually fills out and develops to an athletic appearance. The mental state of the patient shows corresponding changes. They become cheerful, hopeful and alert. The local effect of ultraviolet radiation depends on the amount of pathology encountered, and the changes that have already taken place. The earlier treatment is initiated the greater the chance for a complete cure. The more chronic and involved the condition the longer the treatment and the less likelihood for a complete recovery. Frequently minor surgical measures must be resorted to as adjuvants, such as incision to promote better drainage of pus, removal of plugs of caseous debris and bone sequestra.

Generally, the entire system is benefited by these irradiations. Metabolism is favorably effected. Rothman⁴ and Rollier⁵ have observed that pathologic blood sugar is reduced, and sugar in the urine disappeared. Fat, protein and mineral metabolism is also favorably influenced. Fat is reduced by the increased body oxidation, growth is increased and appetite is improved. Vitamins are activated, especially that of Vitamin D. This may be directly due to the influence of ultraviolet radiation on the ergosterol in the skin. General and local infection is reduced due to an increased immunization of the tissues by the activation of Vitamin A. Hill and Eidenow⁶ have observed increased haemo-bacteriocidal powers following irradiation. Calcium and phosphorous metabolism is specifically influenced which favorably affects not only rachitic states, but also bones in the process of necrosis, softening or hardening. The bacteriocidal powers of ultraviolet have, however, received unwarranted emphasis. The lethal effect is extremely superficial, and any germicidal preparation is cheaper, more dependable and more profound in its action.

Since the ultraviolet rays are extremely su-

perficial in their penetrating powers, it is difficult to say how they influence blood metabolism. This effect may be due to either some biproduct manufactured in the tissues following its absorption or to some photo-luminescent property in the absorbed material. In spite of our present ignorance as to its mechanism, the haemopoietic system undergoes definite and favorable changes. Iron metabolism is improved as noted by the increased hemoglobin index. Similar influences can also be demonstrated in the erythrocytes, leucocytes, eosinophiles and blood platelets. Cramer and Drew⁷ considered that blood platelets are part of the defensive mechanism against infection by bacteria. Doerr and Moldovan⁸ found a rise in the antigenic property of the blood after irradiation by testing its effect on typhoid agglutinins and by its increased resistance to diphtheria antitoxin.

The treatment of extrapulmonary tuberculosis by artificial sources, such as by carbon arc or mercury quartz lamps has yielded equally good results in various conditions, provided a rigid technique was followed. In the absence of solar radiation, the ultraviolet lamps manufactured by reliable concerns are the best substitutes.

In all cases of tuberculosis, whether of the skin, glands, joints or bones, general body irradiation is an important adjuvant to the local treatment. Reyn⁹, Chievitz¹⁰ and Sequeira¹¹ have demonstrated that combined irradiation is more effective than local or general by itself. Reyn reported a 60 per cent cure of lupus vulgaris with local treatment and 90 per cent with the combined method. At the Finsen Institute, at Copenhagen, the treatment is begun with a 20-minute exposure which is gradually extended up to 2½ hours or more for each séance. The entire body is gradually irradiated by sectional exposures at each treatment. Whenever possible, simultaneous open air exposure is utilized to hasten the recovery of the patient.

A factor of greatest importance and entirely overlooked in America is the amperage of the carbon arc lamp. European models usually range from 30 to 75 amperes. The current drawn by American carbon arc lamps average from 5 to 15 amperes. The physician hoping to duplicate the brilliant results of the Finsen clinic with the latter type of a lamp

will be greatly disappointed in the results.

In a period of over seven years I have observed a large number of surgical tubercular cases that came for treatment at the Cook County hospital. Most frequently these patients came to my service following surgical interference and with a history of prolonged hospitalization. Pressure sores were not an infrequent complication. In most instances the irradiation of these patients and the gradual exposure of them to open air yielded gratifying results in the shortest period of time. It was observed that irradiation alone was not as effective in the healing of the lesions as when combined with open air exposure. Even the mental state of the patient showed a notable transformation. He became cheerful and hopeful and sought active occupation—a state in great contrast to his previous depressed state of mind. Particularly is this applicable to those bedridden cases suffering from joint and bone tuberculosis. The fractional method of irradiation has been followed and with more consistent results. This was even applied to the colored patient. The general irradiation appeared to yield more certain results than local treatment. Indeed, it is my present opinion that the local lesion (with exception of skin lesions) can be benefited even to a more marked extent if no special attention is paid to it. The favorable effect generally comes about through the building up processes of the entire body. Intense or persistent radiation over the affected part frequently produces a closure of a draining sinus due to active granulation of the opening. This results in a renewal of pain and local swelling because of the tension of accumulated fluid underneath. The healing processes, if they are to be permanent, must arise from the inner parts or the basement membrane of the wound.

Children appear to improve more readily under solar or artificial radiation than adults. This is a general observation due to either a lessened chronicity of the condition, or to the fact that children respond to the irradiations more spontaneously. The complication most often observed and which markedly delays healing is fistula. In children the percentage of recovery is much greater than in adults, and residual deformities and loss of function are more marked in the latter.

Superficial diseases are more easily reached

and the healing is usually more rapid. Tuberculous ulcers of the tongue and pharynx have yielded favorably to local treatment and general carbon arc irradiation. In the short series of nine cases, seven healed rapidly, one was operated because it involved the entire tongue and suggested malignancy, and one was not benefited. The latter two were also luetic. The total number of ulcer cases was in reality nineteen. Ten did not continue treatment sufficiently long to warrant any opinion, although improvement was noted in the majority.

By far the greatest number of the ambulatory type that came for ultraviolet treatment was the cervical tubercular adenopathy. The majority of these patients was colored and the results proved that a heavy pigmented skin was no barrier for the absorption of ultraviolet rays. The uncomplicated tumescent types showed early benefits from general body irradiation with the quartz mercury lamp. No particular attention was paid to the local lesion. At another period a control group was selected and treatment was directed locally; to another group the treatment was divided so that local and general treatment was interspersed. No particular benefit was observed by the particular method of treatment. The children that received general body treatment were observed to gain in weight and stature. They became brighter mentally. Particularly was this noted in certain of the colored patients who were decidedly backward mentally in the beginning.

Complications were more frequently found in the adolescent type and in a few of the adults. Fluctuating caseous centers were frequently encountered which were not completely absorbed following prolonged irradiation. Surgical drainage was resorted to only as an adjuvant measure to irradiation therapy. The result of primary surgical intervention frequently brings about chronic draining sinuses and unsightly, disfiguring scars. In 44 cases of cervical adenitis, consisting of 20 infiltrated and 24 suppurating types, 75 per cent were discharged as cured. The greatest difficulty encountered was in the fluctuating, caseous type, and in the chronic suppurating type. It is logical to advocate prophylactic body irradiation in all of the early suspected tubercular adenopathies.

All of the suspected and diagnosed cases of tubercular peritonitis are at present treated with these rays at the Cook County hospital. Here the radiation treatment is generalized over the body and also localized to the affected region. The type most favorably affected is the one with ascites. In these cases the results are more quickly apparent than in the types with adhesions. Nevertheless, great patience must be practiced. With the exception of the ambulatory type, many of these patients should be placed in institutions where the treatment is intelligently administered. The patient should be informed that the healing while definite is slow. A prolonged stay should be anticipated.

There is no fixed rule for the dosage of light therapy or the method of exposure. Every case must be individualized, and the reaction to light studied. The symptomatic response and the local reaction are probably the best guides. The closest attention must at first be paid to the reaction of the patient. Insomnia, loss of appetite or fever, are indices of over-treatment, as is also severe erythema. The production of a blistering effect is careless therapy and infrequently leads to difficulties. From the existing rich literature on the subject, and the enthusiastic reports of outstanding pioneers, it is clear that ultraviolet treatment in extrapulmonary lesions is highly beneficial.

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HELIO THERAPY IN TUBERCULOSIS

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Ultraviolet rays are specific in tuberculosis, and their effect is reenforced by visible light and the penetrating infrared rays. The promiscuous use of heliotherapy in this condition is, however, dangerous and should never be attempted except under the direction of a physician trained in this work. It is generally safe in non-pulmonary and in fibrotic, stationary cases of pulmonary tuberculosis.

Rollier's schedule (fractional, 5 minute exposure, back and front, beginning with the legs and working up gradually, on successive days, to full body exposure) should be adhered to strictly. The patient's temperature and pulse should be recorded before, after and one half-hour after each sun bath. If the pulse

has not returned, at the end of thirty minutes, to 20 beats above normal and the temperature to one degree above, the time of treatment must be reduced to one or two minutes and increased very gradually. The treatment may even have to be discontinued, for the time.

The exposure should be carefully worked up to 1½ hours, front and back (a total of 3 hours) and two such treatments should be given daily during the spring and autumn months and one in midsummer. In the winter, treatments with ultraviolet-producing lamps are given, but these are less satisfactory than direct heliotherapy.

Tuberculous cervical glands should receive deep x-ray treatments, in addition to the heliotherapy, in order to produce the most rapid and permanent results. — *Clinical Medicine and Surgery*, Vol. 37, No. 4, April 1930.

PHYSICAL THERAPY IN GASTRO-ENTEROLOGY *

Some Atonic Conditions and Their Treatment

C. F. VOYLES, M.D.

INDIANAPOLIS, IND.

For convenience the term dyspepsia is used to designate a set of symptoms and not a disease. There are three main classes, viz., the organic, the reflex, and the functional. The least numerous class is the organic. The reflex class is larger, and the functional is the largest. Peptic ulcer typifies the organic class, and the gastric symptoms in renal calculus are typical of the reflex class. The perverted gastric function of the neurotic patient with visceroptosis well represents the third or functional class.

The Hypotonic Stomach

The following nomenclature has been used in describing the hypotonic stomach: atonic dyspepsia, gastric myasthenia, gastric motor insufficiency, gastric atony, and some of the gastric neuroses belong to this class, especially the secretory neuroses.

In these cases of gastro-intestinal atony and constipation the neuro-muscular balance is upset, but the mechanism whereby it occurs is still undergoing experimental study. Regarding the myogenic versus the neurogenic theory of the origin of the rhythmic contractions of the stomach and bowels, Alvarez, of the Mayo Clinic, states that the summarized evidence points to a myogenetic origin. He concludes that probably recurring cycles of chemical activity cause the rhythmic contractions. Normally the upper part of the stomach is a hopper with soft muscle structure exerting tonic pressure, while the lower part about the pylorus is a mill with a structure more bulky and tough. The muscle fibers in the pyloric sphincter are more irritable than those in the antrum.

Gastric atony is a condition of reduced or lost tonicity of the musculature. The condition is usually chronic but may be acute as in convalescence from acute diseases. A general examination and x-ray study are indicated, especially to rule out a primary surgical lesion, such as chronic appendicitis, etc. Many of these cases have the hyposthenic or asthenic

type of habitus with faulty posture which I shall describe later.

Vitamin B deficiency may be a causative factor, as indicated by animal experimentation. No doubt another factor is the chronic fatigue found amongst industrial workers. Splanchnoptosis is usually present. The symptoms are here almost continuous, whereas in ulcer the history shows periods of latency. It is not so easy to rule out gallbladder disease; however, this can be done with reasonable accuracy by a full examination, including cholecystography. In chronic cholecystitis without stones a negative report on a primary set of films has little value. If, however, the gallbladder fails to receive and concentrate the dye, pathology is present in more than 90 per cent of the cases.

The x-ray appearance of the hypotonic and atonic stomach is important in diagnosis if an observation is made with the patient in perpendicular position. The stomach is large, long, low and the dependent portion is widened.

The course of gastric atony is variable depending upon the etiologic factors. The patient is usually comfortable with the stomach empty but uncomfortable soon after meals.

Many of the functional dyspeptics offer a poor prognosis as they are congenitally subnormal in their physical and psychic stamina. These atonic cases may have pain simulating surgical pathology in the abdomen; therefore, we should be cautious in advising surgery. Some have already had a series of futile operations. The following case is cited as an illustration:

Dr. X., aged 42 years, lived and practiced in the South. He had functional, atonic dyspepsia with recurring bilious attacks. After being treated a great deal he consulted a leading diagnostician in the South, and another in New York City, after which he went to a famous surgeon and had an exploratory laparotomy performed. Nothing was found except a large, flabby stomach and slight evidence of old pathology at the appendix. The appendix was removed and the patient was better for a short time following this rest in bed. Next he met an old class-mate who had taken up surgery.

* Read at the Eighth Annual Meeting, American Congress of Physical Therapy, Chicago, November 4, 1929.

The patient was promised a cure by draining the gallbladder. This was done but with no better result than before. He was better for a short time following the rest in bed and during the period that he was expecting a cure. Next he went to a southern metropolis and had his stomach plaited up by a method of gastroplication. The results were the same as before. He then returned to his first surgeon who advised that he was a neurasthenic. Next he went to a surgeon in a southern state where he had a cholecystenterostomy performed, whereby the bile was shunted through the gallbladder into the duodenum. The fundus of the gallbladder was anastomosed with the duodenum. The patient nearly died and was in the hospital 16 weeks. After this he was cured of the "surgical operation habit" and gradually regained his health. It is not known definitely whether he had an obscure lesion of the common duct. At last report the patient was a physician to a state prison.

Pneumatic Gastric Gymnastics

In carefully selected atonic cases pneumatic gastric gymnastics for heating and directly exercising the gastric muscle is a treatment of considerable value. Cases are treated daily with the stomach empty. A short, flexible, double current tube is used. The air pressure is controlled by the operator's hand and the patient's tolerance. Also, as a matter of safety, a gauge, set at low pressure, is placed in the air-line. The stomach is alternately filled and emptied, working it like a bellows. This treatment is not original with the writer, and neither is it new. It was used extensively by a few some 25 years or longer ago. Naturally, it would be a failure if the atonic condition was secondary to a disease such as chronic appendicitis, cholecystitis, syphilis or tuberculosis.

Splanchnic Insufficiency and the Sinusoidal Current

Splanchnic insufficiency is a syndrome occurring in some asthenic cases. The patient refers to it as indigestion but it is evidently a circulatory disturbance in the splanchnic vessels. The splanchnic nerves govern the constriction of the blood vessels in the viscera and when nerve function is disturbed, venous stasis results. There is relative vaso-motor paresis affecting the splanchnic vessels. Such patients usually have ptosis. The blood pressure is usually low but is higher with the patient lying down. On rising the blood pressure falls and the pulse rate increases. Vertigo and air-hunger are some of its symptoms.

Physical therapy is indicated and especially the interrupted, rapid sinusoidal current. The

abdominal muscles are contracted at the rate of 16 to 17 times per minute. Also abdominal support to increase the intra-abdominal pressure, and special exercises to strengthen the abdominal wall and improve the posture are indicated. The patient should be taught to live and work within the capacity of his sub-normal circulatory and nervous systems.

The Atonic Colon

Successful management of atonic colon cases with the usual ptosis and constipation includes a general examination, an x-ray study, and a differential diagnosis. Treatment is indicated as follows: Correct general and mental hygiene, prescribe a diet nutritious and stimulating, such as, vegetables rich in cellulose, various fruits and especially the acid ones, buttermilk, and fruit, as oranges or apples at bedtime. Sufficient water should be prescribed and insisted upon. Also calisthenic exercises, and special exercises to correct the posture and build up a strong abdominal wall. Also massage over the colon, mechanical vibration, cold baths with friction, deep breathing and a ptosis belt are indicated. The slow sinusoidal current at comfortable tolerance as a mechanical exercise should be emphasized. For stronger effect the surging sinusoidal or superimposed wave may be substituted. Cases have been reported in which this treatment corrected incompetency of the ileo-cecal valve.

All cathartic and laxative medicines should be discontinued unless the patient should become bilious or acutely ill. Early in the treatment it may be necessary to occasionally use a small enema of sodium bicarbonate or saline solution with glycerine added. Cases with an unstable nervous system should have the benefits of reconstructive and re-educational efforts and psychotherapy. The most effective method of suggestion known to the essayist is that arising from a thorough examination and a favorable prognosis. These atonic cases are nearly all symptomatically curable, but the majority are not cured because they abandon their plan as outlined, and lapse into the lazy habit of taking a pill at bedtime.

The Irritable Colon or Spastic Colitis So-Called

Many, and perhaps the majority, of the irritable colons, commonly called spastic, mucus colitis, should not be classed as a genuine co-

litis. The etiological factors are still in doubt, and are at present the subject of research by leading physiologists and research workers. The mucus present in the stools does not prove it to be a colitis as it suggests perverted function rather than organic change. The mucus discharge subsides when the associated constipation is cured.

The treatment of these cases is very different from that of the atonic class. These cases require a bland constipation diet and sedative treatment instead of stimulative. Many of these colons are very irritable and the diet is a problem. The acid fruits are contra-indicated and the coarse vegetables rich in cellulose over-stimulate and increase the spasticity. The patient omits one food after another hoping to escape discomfort until his diet is vitamin deficient and not sustaining in calories. The sinusoidal current is contra-indicated by reason of its stimulation. Since this paper is a consideration of atonic conditions further discussion of the irritable colon is not in order. It was mentioned by contrast.

So-Called Nervous Dyspepsia

The name "nervous dyspepsia" calls to mind the very old formula for making a rabbit stew. It specified that you first catch the rabbit. Likewise, in treating nervous dyspepsia the main point is to find a case.

If we limit this definition to patients having a hypersensitive gastric mucosa, or to the sensory neuroses, after a careful differential diagnosis, there may be justification for its use; however, it is not an entity. In such cases we should treat the individual and not the stomach, as special diets and local treatment may do more harm than good. It would be well to discontinue the term in the interest of more accurate diagnoses.

Dr. Thomas, of Allentown, Pa., analyzed 100 cases of so-called nervous indigestion with the following result: Gastric ulcer, 4 cases; duodenal ulcer, 5; cancer of stomach, 2; cancer of esophagus, 2; achylia gastrica, 3; incipient tuberculosis, 20; tabes dorsalis, 1; myocardial insufficiency, 9; angina pectoris, 8; Addison's disease, 1; chronic appendicitis, 5; and splanchnoptoses, 7. That makes a total of 69 cases. Among the other 31 were some cases of chronic gallbladder disease.

Visceroptosis

Regarding the etiology of visceroptosis or

splanchnoptosis, the congenital factor is the most important; however, the acquired type is recognized. No doubt in the majority there is a congenital deficiency in the skeleton, the central nervous system and the abdomen, and often an incomplete evolution of the colonic mesentery. The congenital factors are contributed to especially by the following: debilitating diseases of childhood, as rickets; diets vitamin deficient, calorie deficient, and further deficient from the standpoint of colonic stimulation; chronic fatigue incident to school work and social life; chronic fatigue in industrial workers; weakness of the abdominal wall from child-bearing, acute disease and whatever cause; malnutrition and colonic stasis with gaseous distention.

Emphasizing the congenital factor, we cannot conceive of the winning horse in a derby classic being sired by a ewe-necked, sway backed, knock-kneed progenitor; *per contra*, we assume that the sire had an excellent skeleton, a mechanical makeup approximately correct, and a cardio-vascular system and nervous system well above mediocrity.

The Habitus and Physical Aspect

In 1885 Glenard first described this condition under the name *enteroptosis*. Stillter called the condition *asthenia congenita universalis*. The patient is slight of build, the neck inclines forward; the anterior dorso-lumbar curve is exaggerated, and compensatory lumbar lordosis exists. In another type the normal dorso-lumbar curve is absent, the chest is flat and the shoulders round. The costal angle is acute and the 10th rib is unattached. The chest is narrow at its base and the lower abdomen is prominent. The ewe-necked, pot-bellied child should have physical education before he becomes a neurasthenic, tuberculous member of society.

Prophylaxis

When and where should prophylaxis begin? That suggests the reply made by the head of a large reformatory for boys when asked "at what age should we begin to reform a boy." He said: "Begin 100 years before he is born"; meaning, to reform his ancestry down the line of descent. Is the period of prenatal care too early for this work in scientific health building to begin? The pediatricist, the family physician, the teacher, the nurse, and our school authorities all have a responsibility. Nutrition

classes should be especially encouraged. Since nature is resourceful, especially in the young, brilliant results may be expected from efforts properly directed.

Physical Treatment

The following are the important measures in the physical treatment of the ptoses: Properly balanced rest and exercise; deep breathing; abdominal massage; mechanical vibration; suitable diet to increase weight and vitality; gastric lavage in cases of stagnation; the cure of constipation; hydrotherapy for the nervous system; rest cure in bed; and a ptosis belt to increase the intra-abdominal pressure. The sinusoidal current to improve tone in the muscle structure is important. Medical gymnastics to strengthen the abdominal muscles, and special exercises to correct faulty posture are essential. Illustrations showing the latter may be found in the literature on this subject.

Conclusions

1. Perverted function is the cause of the greatest number of dyspeptic cases.
2. Splanchnoptosis is, to a large extent, an orthopedic problem.
3. An abdominal ptosis supporter is indicated in many cases to increase the intra-abdominal pressure.
4. The long J-shaped stomach may be classed as normal for the individual, and it may function well, but it is probably a potential source of trouble.

Discussion

DR. F. H. MORSE (Boston, Mass.): In 1907 I had the honor to represent this country in Rome at the International Congress of Physiotherapy; also, again, in Paris in 1910, and I have had an invitation to go to Belgium next September and I think I shall go.

I read a paper in Rome on the mechanical treatment of autointoxication, and I spoke mostly about treatment. After I got through, a German physician, a lady, arose and said, "Mr. President, why doesn't the distinguished gentleman speak more about his subject?" She proceeded to talk about physiology, pathology, and the conditions that led up to the use of physical measures but she didn't say much about treatment. Her discussion was more valuable than my paper was.

That doesn't apply to the doctor's paper today. It is a very nice paper, but I wish he had said more about the real conditions inside and not quite as much about the stomach.

We are taught that only two per cent of real stomach diseases are due to stomach troubles and

that the real condition, whatever the stomach symptoms may be, is farther down.

I have taken over 7,400 x-rays of the colon with other x-ray work, and I am in position to know that you do not get a clear enough interpretation to make a proper diagnosis of colonic distortions by the oral method.

We know that according to our physiology the rate and rhythm of the stomach is about twenty per minute at the pylorus and about five to eight per minute at the ileocecal valve.

When the doctor talks about interrupted currents, slow sinusoidal, and various methods, why not apply it definitely as we would treat an arm, a leg, a facial paralysis, or any part of the body, in restoring muscular tone instead of the indifferent way it might come from either slow or fast sinusoidal? You know that the sinusoidal current, reversal of the galvanic current, is not the thing to use through the abdomen because the skin offers so much resistance to the galvanic current that you fail to get your deep impulses, and therefore it isn't satisfactory.

The doctor spoke about spastic and atonic, and I am glad he spoke about it the way he did. He spoke about these conditions as being mostly atonic. Alvarez says there are only two kinds recognized in constipation, spastic and atonic. Personally, he never saw a case of atonic. I said I wish Alvarez would come to Boston and I would show him some atonic. When you take an x-ray of the colon or stomach, or both, and the lumen looks smooth, the patient is constipated and there is poor peristalsis. If you treat that patient properly with diet and other measures, the symptoms disappear and there is heavy elimination without cathartics; then, if you take an x-ray, you will find corrugations throughout the area where it was smooth before. One was atonic, and the other is restored vigor. Where is your spasticity?

I don't believe I can quite agree with the doctor in regard to a congenital cause of this condition. When we were children we did like candy, we did eat too rapidly, we did drink too much ice water with our meals, we had an improper, unbalanced diet, and long before we got to the age where we commenced to realize we had stomachs our stomachs were distended. When the hepatic flexure commenced to form a condition which we recognized later in life as chronic cecum infection, which also affected the other parts by twisting motions of the sigmoid, that is where our etiology started. It may run twenty-five or thirty years in its disastrous path of damage, so to speak, before the patient is cognizant of the fact that something is wrong inside.

The doctor spoke of prophylaxis, which is very nice. It would be very nice for a school teacher, and theoretically it is right. We don't see them until forty or fifty years of age when they begin to get uncomfortable.

If you keep away from the abdominal belts, except in acute cases just after convalescing from surgery, and cases where a temporary relief from pain might help out, you will be better off. The more you compress a motion, whether the five layers of the abdominal muscles or the bicep mus-

cle, the more you take the vitality out of that, the less your expansive power is going to be, and you are going to prolong rather than help the prolapses. You are trying to change kinks into curves, wherefore it comes from a distorted physiology into an actual pathology.

DR. F. H. EWERHARDT (St. Louis, Mo.): I want to commend the paper which Dr. Voyles read. I think it was a well prepared and instructive paper. I am going to confine myself just for about two minutes to one or two elements which have to do with the physical therapy part.

He brought out the fact that there was in connection with this situation of splanchnoptosis and atonic colon a faulty posture, with which I agree. Anybody who has had anything at all to do with cases of splanchnoptosis knows that faulty posture is a factor, and many believe it is one of the real causes. In trying to remedy the situation we must remedy that posture. Dr. Mills pointed that out long, long ago.

It is also believed by those who know something about it, that the matter of faulty posture is in the one instance an acquired one, and to a large extent it is hereditary or congenital. I believe the author referred to that situation. There are many of us who believe that there is a congenital factor. Dr. Morse evidently does not believe that.

Also, I do not agree (digressing just a moment from the paper which the author presents), to what was said by Dr. Morse with respect to rhythm. He gave me the impression that it was far better to use a modality—begging Dr. Lake's pardon—to use an agent which would harmonize with the synchronization of the skeletal muscle contraction, intimating that there was a special rhythm for the arm and leg. I have yet to have anyone prove that to me, although I have heard it for ten years. There is no such thing as a normal rhythm for skeletal muscles that I have ever heard. That is true of involuntary muscles. If what I said is true, that it is quite proper to use a low current voltage in order to stimulate the muscle contraction, I agree that is indicated.

I will come one step further along this same line of argument. In other words, I will say that the proper method of attack, it seems to me speaking just from the physical viewpoint, is, first, to correct the patient's posture; secondly, to stimulate the general body tone. The last one can very easily be done in an institution or at home. It can be done as suggested by the speaker, by means of hydrotherapy or contrast baths, the hot and the cold, either by means of a Scotch douche or at home by means of an excellent shower bath. It not only stimulates the muscular tone, but it also stimulates the general nervous system, and that needs to be stimulated in these cases whether it be an adult or a child, more particularly an adult, a woman past forty or fifty who has had several children and has a lax abdominal wall.

The second point I would make is that the patient should be taught how to stand. I have yet to find a patient who, when I asked that patient to stand straight, could tell me how to stand straight. Therefore, they must be taught by the doctor how

to stand straight. Then they must get the correct exercise.

Very briefly, I will refer to only one situation which seems to be so misunderstood, and that is the question of abdominal exercise. In many of these cases, we are dealing with a lordotic condition. Picture for yourself for a moment one of these women with pronounced lordosis. With it we have a forward tilting of the pelvis. Recall your physiology, and you will remember that muscles will adapt themselves to position. Therefore, when the pelvis is tilted forward, the hip flexors are shortened.

The more commonly prescribed exercise for strengthening of the abdominal wall is to raise the legs from the lying position, which I think is wrong, and that is the point I want to make. In the correction of this situation (I am talking about the bad posture, the long abdominal wall), the thing we want is to strengthen and shorten the abdominal wall, to raise the pelvis, to flatten the back, and to stretch and lengthen the hip flexors. We want an exercise which will do that.

Recall for a moment what will happen when you have a patient lying on the back and you ask that patient to raise the legs. What muscle group does that exercise? The hip flexors. Is the abdominal muscle the hip flexor? It is the hip flexors or the psoas and its allied group. Therefore, that is a wrong exercise. What shall we do?

Place the patient on her back. Ask her to bring the heels up to the buttocks. That is a starting position. Then you ask her to bring the knee to a position over her head and then back again. That exercise will do this: It not only strengthens the abdominal muscles but shortens them and, remember, that is what we want.

Apropos, I also want to say at this point that is where we want a corset. When you have a long, weak abdominal muscle, then you must give that muscle a chance, just as in a paralyzed muscle, to recuperate. Therefore, temporarily, we give corsets and we have found that is very successful.

So, we want strengthening of the muscle; we want shortening of the muscle. That exercise also flattens the lower back. In other words, it stretches the shortened spinal muscles and that, in short, is the exercise which I prescribe for abdominal exercise.

DR. G. B. LAKE (Chicago): I should like to have just about 100 seconds to throw a monkey wrench in to the machinery. There will be nothing personal about this because I don't know whether Dr. Voyles chose his own subject or whether it was foisted upon him by the Program Committee. I can only admire his boldness in endeavoring to discuss in twenty minutes a subject which has filled volumes of from several hundred to one thousand pages. The large part of the discussion, since I have been in this section this afternoon, has reminded me of the old-fashioned Hubbard dress that covered everything and touched nothing.

It seems to me, instead of trying to cover the whole of a subject which has required the life time of a number of investigators to study and many bulky volumes to set forth, it would be very much more to the point, as long as our discussions in

these meetings must be limited to a comparatively few minutes, if the essayist would pick out one aspect of the subject and give us a real discussion of that one thing.

I know perfectly well that if Dr. Voyles had taken the subject of the physical treatment of gastroptosis, in twenty minutes he could have told us a lot about it and left us to study the whole question of dyspepsia during the next three or four years.

I suggest to the Program Committee, if they are the ones who chose these subjects, and to the essayists of this section if they happen to be chosen to read papers next year, that that would be a mighty good idea. I simply submit that for your consideration, and for what it may or may not be worth.

Dr. C. F. VOYLES (Indianapolis, Ind.): I believe that the difference between Dr. Morse's views and mine are more apparent than real on all the points except two.

In regard to the minority of our cases being due to stomach pathology, I heartily agree and thought I had brought out that point. In fact, I stated definitely that the organic cases constituted the smallest percentage. Dr. W. J. Mayo has been quoted as saying that one case in ten that comes there with gastric symptoms has stomach disease, and that has been about the percentage in my practice.

In regard to the x-ray examination, the doctor seemed to have the impression that I based my observations on my x-ray study on the giving of barium meal only. I attach just as much importance, and more importance, to the barium enema in studying colon conditions.

In regard to the relative percentage of atonic cases and hypertonic colons, the spastic irritable colons, I did not mean to convey the impression that I think the majority are atonic. I discussed

the atonic cases because that was my subject, and largely omitted the spastic because it was outside the domain of my paper. My personal views are that we have a much larger percentage of hypertonic cases than we do the atonic cases.

Whether visceroptosis is largely a congenital condition, I simply leave this with you: Lately I have perused fifty reprints of papers by good men in the United States, Canada, England, and Australia, and the opinion was overwhelmingly in favor of the condition being largely congenital.

As to the abdominal belt, I agree with Dr. Morse that if we keep a patient cased up without the special exercise I alluded to, we can readily do harm. A great many of the most capable in our profession, I think, endorse the ptosis supported if properly used in connection with the exercise I mentioned for increasing abdominal pressure. That is what Masson of the Mayo Clinic said. I don't know of anybody who prescribes it in the hope of restoring the abdominal organs to their original position. In regard to these cases being advanced when they come, Dr. Morse is entirely right about that. My discussion of the earlier phase of the subject was simply to remind us of the duty we owe to the community to insist upon the children being taken care of better.

As the time is growing short, I shall not discuss further except in regard to Dr. Lake's comments on the paper. The committee did not select my subject. I selected it myself, and as the committee wanted it I felt under obligation to submit my subject early, and it was submitted before the paper was written. I admit that too much ground was covered. I heartily agree with the doctor it would be better to limit ourselves to a narrower field and go into it more thoroughly.

TUBERCULOSIS IN CHILDHOOD

By Gerald B. Webb, M.D.,
Colorado Springs, Colo.

A child can have any type of tuberculosis, and pulmonary involvement is not rare. The chief means of diagnosis is the x-rays. Tuberculin is not greatly depended upon at present. Many patients have tuberculosis. The question is, has tuberculosis got the patient?

The highest death rate from tuberculosis occurs during the *first three years* of life. The earliest sign is often nervous irritability and fatigue. Loss of weight is relatively rare—some of these children are over-weight. Ex-

tensive tuberculosis involvement may be present with *no symptoms*.

All children should have an x-ray study of the chest before tonsillectomy. If this shows nothing, but there is still cause for suspicion, the abdomen should also be studied in the same way, and will frequently show positive findings.

Tuberculous pleurisy, in children, gives no pain and is frequently overlooked. These patients must be observed and treated for years. If they are allowed to exercise too soon, they are liable to suffer a relapse, with a febrile reaction.—*Clinical Medicine and Surgery*, Vol. 37, No. 4, April 1930.

ON TO SAINT LOUIS!!

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ULTRAVIOLET IN TUBERCULOSIS

Several decades ago the tubercular patient represented a difficult problem of the medical profession. Since that time marked advances have been made in the prevention and cure of this malady.

It is today generally conceded that nothing resembling any specific, whether in the nature of a chemical product or a pharmaceutical, has resulted from the vast researches that have been carried on in every land, in most every seat of learning, and even in the humblest laboratories of the individual investigator. Thus far a tremendous amount of energy and money has been expended in the search for what Paul Ehrlich was wont to call the "particular magic bullet for the particular disease—" a colorful description of the meaningful word "specific." Enthusiasm in that direction is today burning not as brightly as yesterday, but is nevertheless persistent and steady. Indeed, the spirit of resolute persistence in the presence of constant failures is a healthy sign of the intellectual resiliency of the medical profession. Our problems seem never to be relinquished, but are passed on to the younger generation who in turn attack the issue with the vigor and optimism of youth. Youth is, however, adventurous, and frequently rebellious to the benevolent restraint placed upon him by the elders in the profession. Radical departure from the beaten path is a heritage of the inexperienced and of humanity in its adolescence.

Imbued with this radical spirit of self-expression was Ikhnaton, the youthful Pharaoh of ancient Egypt. He sacrificed an empire for his religious conviction. The supreme deification of the sun was his royal edict, and paradoxically, his command to sun worship resulted in the spread of sun therapy. In modern times heliotherapy received its greatest impetus from the enthusiastic labors of three tubercular youths adventuring into the Alpine mountains for health, namely, Bernhard Rollier, and Dorno. Artificial sunshine was exploited for its therapeutic possibilities by a Danish youth, Finsen. At his premature death, in the early forties, Reyn, a youthful disciple, took over the leadership at the Finsen Institute at Copenhagen.

What may be considered at first glance as an opposite departure in the search for a cure or alleviation of the tubercular patient by these modern pioneers of heliotherapy was nothing more than a split in the method of attacking the problem by some of the workers in the field. No doubt much of the interest of sunshine as a therapeutic agent arose from the accumulated and scattered observation made by lay people in regard to its efficacy as a curative factor. Much of the inspiration to investigate this phase of the problem was also inspired by the sterile efforts of the research workers in the field of drug therapy. As is usual, when a problem offers difficulty in its solution, it either falls into disrepute, or if it is of sufficient importance, other methods are tried. It has been by the trial and error, and error and further trial that some of the most startling discoveries in medicine have been made.

Out of the vast literature that has sprung up in connection with the management and treatment of the tubercular patient, certain phases have been persistently emphasized as follows: — 1 — that extrapulmonary lesions can be cured in the largest percentage of cases provided they are treated with open air and sun therapy; or, in the absence of the sun, the substitution of artificial ultraviolet sources, such as the carbon arc lamp and mercury in quartz burners. 2 — The earlier the treatment is instituted and the more individualized the treatment the greater the assurance of the restoration of the part to a normal state. 3 — Natural or artificial sunshine are in themselves not as efficient as when combined with open air treatment. 4 — Open air treatment is a failure unless combined with ultraviolet in some form. 5 — In the presence of active treatment as advocated above, aggressive surgical interference must be limited to only that degree which would constitute it as an adjuvant measure.

It will be observed that the authors of both of the current articles in this issue dealing with ultraviolet treatment of the tubercular patient stress natural and artificial sources of ultraviolet radiation and advocate the conservative method of fractional radiation according to the technic of Rollier and Bernhard. There is also unanimity of opinion in regard to the value and position of open air treatment for the surgical lesions — a fact

which is universally conceded except amongst the disciples of the Copenhagen school of Finsen or Reyn. Reyn and his associates claim that their experience, based on a very large series of cases of various forms of tubercular bone and joint lesions, permits them to deny the contentions of associated open air treatment. According to these workers, artificially produced sources of ultraviolet in itself have a powerful influence on tubercular lesions. A short extract from Reyn's paper, delivered before the British Medical Association in 1923⁽¹⁾ is included because of his distinguished position and authoritative voice on things pertaining to the practice of artificial ultraviolet therapy. He says:—

I should like to make a comparison with the results obtained by Rollier, calling to mind, however, that he is working under much more favorable conditions with his patients *inside* his hospital.

Ankle joint—of 94 cases complicated and non-complicated, Rollier registered 87 (92 percent) as cured. Of the 47 cases which Ernst (Finsen Institute) includes among ankle joint tuberculosis, we have cured 42 (89 percent), and 36 of these cured patients have regained complete mobility of their limbs.

Tuberculosis of the Elbow—The proportion of cures by Rollier is 66 percent; we have to record 83 percent. The results we have had in treating different forms of surgical tuberculosis *are at least as good* as those obtained by heliotherapy in the mountain heights.

A point of importance that is seldom stressed is the fact that Reyn used lamps of excessively high amperage (75 amperes), and his treatment time was progressively increased to a point far beyond that advocated or made use of in American institutions. It is reasonable to assume that only by a reduplication of the technic and the utilization of sources of the same intensities can the same results be anticipated.

Until recently pulmonary tuberculosis was considered as a contraindication to ultraviolet radiation. Due to the negative experiences of the pioneers in heliotherapy, pulmonary types have been generally excluded from treatment because of fear of hemoptysis and activation or lighting up of a focus. Indeed, the reports have frequently indicated that this was more

than a theoretical possibility. To a few adventurous investigators this was a stimulus for cautious observation. By avoiding the acute cases and initiating the patients with suberythematous doses much of value has been accomplished.

Light treatment of pulmonary cases is now almost universally adopted in Denmark. Wurtzen,⁽²⁾ the medical adviser on pulmonary tuberculosis to the Finsen Institute says:—“The results achieved have been so promising to Danish pthisiologists that light treatment of pulmonary tuberculosis *has spread from here to all sanatoria and all hospitals containing similar cases—it has been adopted everywhere as a regular form of treatment.*” Detailed results were also reported by Weinbren⁽³⁾ in a series of 123 cases of pulmonary tuberculosis. He concludes:—“Provided that the patients are selected, chronic pulmonary tuberculosis with a low degree of toxemia not only may safely be treated but will give good results. There is no danger of hemoptysis in these cases if they are carefully controlled. Over exposure may produce hemoptysis. There is little danger of turning a quiescent into an active lesion if the doses are increased carefully. The contraindications depend on the state of activity and consequent toxemia, not on extent of involvement.”

An interesting experiment was carried out in Italy by Blasi,⁽⁴⁾ to determine the defensive powers of children from 14 months to 9 years of age against tuberculosis, by the action of ultraviolet upon such irradiated subjects. In all cases a Pirquet test was done before irradiation. Each patient received a total of ten ultraviolet light treatments beginning with an initial two minutes and gradually extending the time of exposure. The distance in all cases was constant, 60 cm., both the anterior and posterior part of the body was included in the treatment. A period of 24 hours was insisted on as an interval between the first and second treatment. Thereafter treatment was given every day. Accordingly each child was eventually irradiated up to 20 minutes. ‘Opsonic index’ were made on each patient. Blood was withdrawn from each fasting child an hour before treatment was instituted and an hour after treatment was finished, and the results compared on the basis of the tubercle bacillus. Those with positive Pirquet before treatment were more marked than the children with negative. All children who re-

ceived treatment showed an increase in the phagocyte count as well as demonstrable phagocytosed bacilli.

¹ A Review of Artificial Light Therapy, R. King Brown. (Page 16). London: The Actinic Press, 1929.

² A Review of Artificial Light Therapy, R. King Brown. (Page 14). London: The Actinic Press, 1929.

³ Weinbren, H.; 2nd Int. Conf. on Light and Heat in Medicine, London, Oct.-Nov. 1928.

⁴ Clinica Pediatrica (Modena) Sept. 1929.

IKHNATON: APOSTLE OF SUN WORSHIP

The story of Ikhnaton, the greatest of all sun worshippers, is a strange one, and today, after the lapse of over thirty centuries, we read it with sympathy and a measure of understanding. The worship of the sun-god was already gaining power in Egypt as early as 1400 B. C. under the magnificent emperor, Amenhotep III. When this Pharaoh died in 1375 B. C., his son and successor, Amenhotep IV (Ikhnaton, assumed the office of high priest of Aton.

The new emperor became dissatisfied, however, with the status of the sun-god. Sun worship was not the state religion. The worship of Amon and the more ancient Egyptian gods was the state cult, and Amon was the state god at Thebes. Aton, according to the concept of the young Pharaoh, should be alone, supreme, the only ruling and divine influence, the only god. Impelled by this conviction, Amenhotep IV decided to destroy Amon and the works of Amon, and place the sun god, Aton, supreme in Egypt and the world. The fact that his name, Amenhotep (Amonhotep), contained the name of Amon and signified, "He in whom Amon is content," caused him disquietude. He, therefore, cast it off and chose another name, Ikhnaton, which means, "He in whom Aton is satisfied."

Ikhnaton, known later as the heretic king of Amarna, became, in reality, a heretic to all phases of old traditional belief. He was not a mere passive heretic, content with his own convictions. He was active, militant, and wished to impose his new convictions on the world. He was a fanatic in the new concept of his sun worship. He could see no other dogma, could feel no other godlike influence. He started a dreadful persecution against the Amonite priesthood which had grown immensely powerful throughout Egypt. He destroyed their altars, broke their power, and made Aton, for the time, supreme, the one and only, the true god. He even hewed out from

the monuments the word "Gods," as the plural indicated other gods than Aton.

He went farther; the iconoclastic young fanatic even expunged his own father's name, Amenhotep, from the walls and monuments. He felt that his father's name, as it contained the name of the debased and false god, should be destroyed utterly in the interest of the new worship. He ruined the magnificent Theban palace of his ancestors by the erasures and blemishes made as he blotted out the detested name of Amon.

The young Amenhotep IV, or Ikhnaton as he was now known, found his position at Thebes insufferable. His dreadful revolution, violating as it did all tradition and all religious tenets sacred to Egyptian memory, had alienated the people and surrounded him with enemies. Like all great religious pioneers, he must have undergone devastating mental anguish, crushing spiritual agony, and the gray despair of crumbling illusions. He forsook his capital, the magnificent residences of his forefathers, and built a new capital, Akhetaton (Horizon of Aton), which is known in modern times as Tell el-Amarna. Unfortunately, immersed as he was in his religious enthusiasm, guided by governmental principles which even today would be termed international and idealistic, he was unable, apparently, to cope with the material problems of his environment, and before his death lost a considerable portion of his empire.

Ikhnaton is one of the most interesting, if not *the* most interesting figure in the whole course of Egyptian history. The rebel Pharaoh was a strange blend of genius and fanatic. The skull found in the coffin supposed to be his is one of the largest human skulls ever seen. This may mean something; it may mean nothing. In the meager light of the knowledge we possess, the man seems to have been gifted with extraordinary qualities, to have enjoyed extraordinary insight into spiritual things. He was the first universalist, the first internationalist, a believer in equality and brotherhood, whose cult was that Aton shone for all—for rich and poor, for the king and for the peasant. His life, as we read it in the dim, half-light of Egyptian history, is a weird fabric interwoven with dominant threads of fanaticism, passion, idealism, individualism, courage. He was the first to step forth from the colorless line of the Pharaohs,

the first to flame with new ideas, the first to have the strength and courage to break with inbred, traditional beliefs.

The sun meant to him purity, health, life, truth. He it was, we are given to believe, who devised the emblem of the sun-god seen on page 264. It was he, too, supposedly, who wrote the hymns to Aton, fragments of which are still extant and which portray, to some degree, the fascinating personality of the man. In one hymn, describing night and its awakening, Ikhnaton sings:

"When thou settest in the western
horizon of the sky,
The earth is in darkness like the
dead."

* * * *

"The barques sail up-stream and
down-stream alike.
Every highway is open because thou
dawnest.
The fish in the river leap up before
thee.
Thy rays are in the midst of the
great green sea."

When speaking of the sun god as the creator, he sings:

"When the fledgling in the egg chirps
in the shell,
Thou giveth him breath therein to
preserve him alive."

Unfortunately, this greatest of sun worshipers could not convert the mass of the Egyptian people to his beliefs. The people were willing to have a sun-god. They were not satisfied, however, with Aton alone. They must also have their other gods, Amon, Isis, Osiris and the rest. This, Ikhnaton would not permit. He saw nothing in Amon, or Isis, or Osiris but ignorance, superstition, tradition, priestly mysticism and unfounded dogma. The sunshine he saw and felt. It warmed his blood, cheered his heart, exorcised the demons of the night, dissipated the fogs and the darkness. Aton was real, Aton was warm, Aton was sunshine, Aton was courage, and truth, and health. He preached and fought—largely in vain. The people would not follow. The Amonite priesthood seceded against him. He remained, to the last, unshaken in his convictions. His sun worship and his religious enthusiasm cost him his empire and, perhaps,

his life. He died about 1358 B. C., at about the age of thirty.

Those, today, who are interested in sunlight, experience a sense of surprise and admiration as they read of Ikhnaton, the greatest of all sun worshipers. The most ardent heliotherapist of today can take lessons in devotion and singleness of purpose from this Egyptian of over three thousand years ago. What would have been the result if Ikhnaton had succeeded in making his sun worship supreme and universal? This speculation is of surpassing interest.

Sun worship, as Ikhnaton conceived it, would have been infinitely better than the worship of the plural Egyptian gods. In later ages, probably, the study of the sun, as incident to sun idolatry, would possibly have led to early recognition of the actual therapeutic values of sunlight and, conceivably, to an earlier knowledge of the physical properties of light.

The sun has been worshiped in some form, in every age, by every primitive race. Nowhere in history, however, do we note a parallel figure to Ikhnaton, an individual imbued, as he was, with a consuming adoration of the sun. Present day heliotherapists might appropriately designate him as their patron spirit. They might, while of course avoiding his fanaticism and dogmatic error, profitably copy his courage, superb enthusiasm and unwavering singleness of purpose.

THERAPEUTICS OF HEAT AND COLD

A timely article on this subject appeared in the *May* issue of the *Dental Cosmos*.¹ Heat and cold are therapeutic agents of considerable value in medical and surgical practice, and, no doubt, have been utilized to advantage, also, in dental practice. The dental surgeon, however, is not so cognizant of measures somewhat outside of his realm which aid in the more expeditious healing of pathologic processes. Heat has always been recognized as a means of relieving pain. When heat is not well tolerated, or in the beginning of an inflammatory process, cold is usually the measure of choice.

Levitt, the author of the article in the *Cosmos*, aptly reviews for the benefit of his colleagues, some of the physiologic and mechanical principles involved in the application of heat and cold as therapeutic aids. "The ef-

fectiveness of cold is principally due to the mechanical abstraction of heat and not, as is supposed, to its reflex action upon the blood-vessels, causing vascular contraction. Heat is a necessary element in the process of inflammation and no inflammation will take place unless a favorable temperature is maintained. The application of cold must therefore be regarded as mechanical and not physiological in principle, and should be applied only when it is desired to *interfere with or retard the processes of inflammation by removing one of the essential elements of the process itself—heat.*"

After considering briefly some of the indications for heat and cold from the standpoint of the classification of inflammation, Levitt summarizes the subject, emphasizing that cold applications have a limited use in dental practice and only in the treatment of acute inflammation in its early stages. When inflammation ensues as the result of injury to tissue, heat is required. Cold if promptly applied will retard inflammatory changes, but its action is mechanical.

The influence and therapeutic use of external heat was discussed at length in a report² by the council of physical therapy published nearly three years ago. In this article the physiologic influence of external heat is considered from the points of view of systemic and local exposure. But, it is added: "Heat must be considered also, from the standpoint of its therapeutic use, under two general headings; viz., dry and wet. Dry heat includes exposure to the heat of the sun, to hot air and to heat radiated from heated articles, such as hot bricks and sand, electrical resistance coils, electric lamps and the actual cautery." Another form of exposure is afforded by "diathermy," the heat supposedly developed not by an external object, but by the electrical resistance of the tissues themselves to a current passed through them. Under wet heat are included such sources as the hot bath or the hot pack.

It is extremely interesting to note that both heat and cold are being appreciated as remedial agents, more and more. As has been remarked they have always been utilized in some form. The source of an energy such as heat, may play little if any role theoretically, but practically it is indisputably associated with wave length. We know from a large ex-

perience that today by means of improved sources of heat more intensive clinical effects can be obtained. The field of usefulness of heat energy as a therapeutic factor is being widened constantly. Not only for general medical and surgical affections, but also for special indications is its influence being appreciated.

Levitt's brief but appropriate exposition of the value of heat in dental inflammations is, of course, based on the action of heat on inflammatory processes in general. The Council's report reviews some of the effects with reference to inflammatory conditions of joints and bursae in which the application of heat may be more harmful than beneficial, although acute bursitis may be favorably (?) influenced by diathermy.

It is well for the beginner who attempts to apply physical measures to understand the fundamental physical principles of heat, for only in this way can the correct source be selected and the energy rationally applied in the treatment of disease. The physical classification of *conductive, convective and converse* heat lends itself also to a classification on the basis of clinical uses. One should be familiar with the sources which are capable of producing the type of heat indicated in a given malady. One should know also the limitations of thermotherapy. It has been stated that most of the common methods of applying heat to the body have other effects than that of simple heat production. This subject is too controversial to enter upon at this time. However, its significance merits thorough scientific investigation.

To summarize this discussion, three important facts should be emphasized: (1) heat and cold are valuable remedial agents which are capable of influencing inflammation in its various stages; (2) the sources of these agents and their methods of application bear a direct relation to the extent of the clinical action produced by them; (3) the type of energy desired for use in a given disease depends largely on the selection of a source capable of producing it, and to properly evaluate this fact an understanding of the underlying fundamental physical principles is essentially necessary.

¹ Levitt, Boris, D.D.S.: Therapeutics of Heat and Cold in Dental Practice. *The Dental Cosmos*, Vol. LXXII, No. 5, May, 1930.

² Report of the Influence and Therapeutic Use of External Heat. *J. A. M. A.*, Vol. 89, No. 15, October 8, 1927.

PHYSICAL THERAPY CLINICS

ARTHRITIS *

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It is evident that arthritis is one of the earliest known diseases. The Egyptians record it, x-ray examinations of their mummies prove it; the Romans had an elaborate system of *thermae* (baths), and solaria for its treatment. The word "rheumatism" is of ancient origin, and of unscientific derivation. Hippocrates imagined that there were four "humors," or "rheums" which somehow mysteriously circulated in the human body; these humors were blood, phlegm, yellow bile and black bile, according to his notion. The Greek word *rheo* (rheum) means to flow. Consequently, rheumatism means a disarrangement of these mysterious flowing substances. Shakespeare, in speaking of tears, says: "At a few drops of woman's rheum, which are as cheap as lies." When these circulating "fluids" are in easy and comfortable progress, we are said to be in "good humor," or in good "rheum."

Whether we really know much more than the ancients about "rheumatism" seems a question. The pathology we know, also the symptoms, and the changes in tissues. But the real cause—who can say with assurance? We speak glibly of foci of infection, teeth, tonsils, appendix, prostate, colon, gall bladder, and what not. We say that this attempt of nature to eliminate infectious processes manifests itself in inflammatory changes in muscles, joints, and peri-articular membranes. There are pain, swelling, exudation, and hypertrophic changes. But arthritis occurs without discoverable foci of infection; again, there may be marked foci without arthritis.

There is much confusing nomenclature descriptive of arthritis, such as arthritis deformans, infectious, traumatic, gonorrheal, rheumatoid, myositis, polyarthritis, gouty, etc. Probably the best definition is proliferative and degenerative, or atrophic and hypertroph-

ic. These appear not so much definite diseases as they are reactions of the joint tissues to a variety of causes. Osler speaks of arthritis, or rheumatic fever, as an acute infection, depending upon an unknown infectious agent, and characterized by joint affections, myocarditis, and a marked tendency to inflammation of the endocardium and valves of the heart. While infections of bacterial origin are found in a large number of cases, there seem many other factors of causation. The active infectious process seems a single incident in a long chain of events. Apparently there is an endocrine element in the etiology, with involvement of the sympathetic nervous system; the arthritis of the menopause may be accounted for in this way. Food allergy has been ascribed a place in the etiology of arthritis. Recent observations seem to show that the lactic acid content of the blood is no higher in arthritic patients than normal. Sweating methods, sometimes used in the treatment, may have values, but not because of their elimination of lactic acid.

Lowered sugar tolerance seems generally to accompany arthritis. Disturbances of circulation are a part of the underlying pathology, especially of the peripheral circulation. Pemberton states that in a group of cases studied, it was possible to lower sugar tolerance by interference with the peripheral circulation.

Arthritis prevails in temperate and humid climates; it is said to be rare in the tropics. May not this be due to the abundance of ultraviolet in the southern climates? We know that arthritis prevails in the northern climates, where there is a minimum of ultraviolet. This fits in with the endocrine theory, since ultraviolet seems to affect profoundly the endocrine system.

Crowe is very strong in his belief that focal infections practically always exist, especially

* Clinic conducted at the Eighth Annual Meeting, American Congress of Physical Therapy, Chicago, November 6, 1929.

streptococcic infections of the teeth, but states that foci, or supposed foci, have been removed without any change in symptoms. The resistance of the patient may be undoubtedly weakened by streptococcic invasion of the blood stream. Cultures from infected teeth invariably show the presence of streptococci; other germs may or may not be present. The *strep. salivarius* is a variety of short chained organisms held at the roots of dead teeth; there may be very little suppuration in a chronic streptococcus infection, quite often no suppuration at all. Brock (1921, Mayo Clinic), produced arthritis in 144 animals out of 160 by injecting streptococci isolated from infected teeth. Forms of myositis and neuritis occur apparently from the same cause. Different organs are affected, according to the resistance of the host. The reaction around infected teeth differs in different people. There may be rarefaction (apical granuloma), with which all are familiar, or there may be condensation of bone. The defense mechanism seems high in apical granuloma, low in condensation of bone (condensing osteitis), and resistant individuals develop granulomata, susceptible individuals not. This conception (Price) explains the reason why some people whose mouths are obviously septic are in apparently good health, while others suffer serious systemic disturbances from only one infected tooth.

The defense reaction in arthritis seems of great importance; an overload of bacterial invasion lowers the vitality of the individual, and hence the onset of disease. Intercurrent conditions such as "flu," exposure, grief, age, pregnancy, lactation, etc., break down the defense mechanism. Exposure to cold has always been considered a cause of arthritis; this seems true, and borne out by some recent experiments on rabbits. The hindquarters of the rabbits were placed for a considerable period in ice-cold water. Streptococcic cultures were then injected into these rabbits, as well as into controls. The first group developed severe arthritis, the latter group was unharmed.

The theory that dental infections disturb the acid-alkali balance, thus preventing completion of catabolism, seems reasonable. Acid products collect, and the system uses calcium to neutralize the acid. This is Price's explanation of the loss of calcium which is so marked a feature in some arthritic changes. The long continued production of acid leads to degenerative changes. The use of ultra-

violet by means of direct sunlight, or the carbon and mercury vapor irradiation, seems a very rational sort of treatment, especially if there is a calcium deficiency. Many writers stress the importance of the bowel as a focus of infection, and state that intestinal streptococcic invasion is more frequently a cause of arthritis than any other. No doubt the bacteria are conveyed from infected teeth to the intestinal canal.

Physical Measures

In brief, our attempts by means of physical measures are to relieve pain, to secure a maximum efficiency of movement, and to increase the general powers of resistance of the patient. Foci of infection should first be considered, of course; and the general hygienic measures applied. Among these latter measures, warm clothing, attention to the elimination, residence in a warm climate, and the intake of sufficient water should be stressed. Many arthritics drink too little water, since the restricted amount of exercise which is possible does not promote thirst. The chief values of many springs and sanatoria lies in the psychic and social influences. The cheerful environment and sunshine have a marked physical effect which is altogether beneficial. Various forms of hydrotherapy often are productive of fine results. Rest should be maintained in all acute stages, and as long as motion causes considerable pain. These are some of the reasons for rest: the body cells are busy combating infection, and their energy should be conserved as much as possible. Certain tissues are undergoing changes because of inflammation, and are struggling to accomplish repair. A very important reason for rest in the acute stages is the specter of cardiac involvement which is never absent from the disease, especially in the acute stages. Any increase of activity may increase the possibility of cardiac inflammations.

Local and external measures seem of definite value in treatment, such as hydrotherapy, massage, passive motion in subacute and chronic cases, and dry heat in the form of infra-red irradiation, or radiant heat and light, (the so-called light bath). Heat in some of its forms is the most applicable of physical therapy measures, and beneficial for the following reasons:

1. The relief of pain: while heat may not

cure the disease, it gives at least temporary relief.

2. The *production of hyperemia*: flushing the parts with rich red blood is nature's method of cure. The increased activity of the lymphatics tends to remove inflammatory products.

3. The *inhibition of bacterial invasion*: increased metabolism.

4. The *delivery of oxygen to tissues* is dependent upon many factors, heat being a prominent agent to bring about this result. It prevents stasis.

5. Heat brings about active sweating.

Massage is an important aid in treatment. It is a much abused agent; too long and hard treatments are inadvisable. The chief value of massage is its effect in increasing the blood supply to parts, and as a form of passive exercise, overcoming effects of enforced inactivity. In acute inflammatory processes it should not be used unless very lightly.

Manipulation of affected joints should be begun as early as possible to prevent ankylosis. This calls for careful treatment; heat should be applied before massage or any stretching or bending movements are given. In chronic cases, stronger movements may be used. The galvanic current is often useful in promoting muscle contraction, and in giving a deep exercise and massage to the parts. *Diathermy* has great values. It does not seem that we may hope for the absorption of bony

exudates in hypertrophic cases; in old cases, it is doubtful that diathermy will increase motion in ankylosed conditions. It does seem, however, that diathermy will *prevent* to a considerable degree the formation of exudates, and the atrophy of cartilage. The arterial hyperemia intensifies the action of drugs, hence diathermy is an adjuvant in the administration of salicylates, and other drugs.

The methods of application of diathermy vary with the cases in hand. In brief, *opposite electrodes* seem a more direct treatment than can be secured by any other method. The cuff, or half-cuff electrodes are indicated in certain cases, also the foot-to-foot method. The chair pad, as the indifferent electrode is very efficient, and may be used in many cases. Long treatments with a mild current are to be preferred to short intensive treatments.

Exercise. After the acute and painful symptoms have passed, exercise is of great value. A moderate amount of function of the affected joints prevents ankylosis, improves circulation and nutrition, and is desirable in all cases. Since "function makes structure," the arthritic patient should be encouraged to carry on. In some cases, taking to a wheel chair pronounces the doom of the patient. Discouragement and apprehension should be removed by the tactful physician. Some interesting occupation which calls for physical movement is often a God-send to those who are afflicted with this baffling and uncomfortable disease.

Activated Ergosterol (Viosterol) in Radiation Sickness. L. A. Smith.

Am. Jour. Surg. Dec. 1929.

The reactions experienced, following radiation treatment by roentgen-rays or radium, may be immediate or late: The immediate reaction may comprise malaise, loss of appetite, headache, fever, nausea, etc.; the late reactions cause nausea, abdominal pain, fever, diarrhea and cachexia.

Various theories of causation have been put forward, but disturbance in calcium balance seems the most plausible. For this reason, treatment by activated ergosterol (viosterol) has been suggested and tried.

Smith reports that, in 55 cases so treated, most of the patients received the medication after the first day's fraction of the dose of radiation had been given; but when the viosterol was begun 12 to 24 hours before any radiation treatment, the results were markedly improved. Four (4) minims was the

dose, twice a day for the adult; when symptoms threatened, in spite of the routine prophylaxis a dosage of 8 minims, three times a day, was occasionally ordered, with apparent benefit. As a rule, the viosterol was discontinued 12 to 24 hours after completion of the radiation treatment.

Seventeen (17) patients, previously nauseated by irradiation, experienced no nausea following viosterol; 28 patients, not previously irradiated, experienced no nausea during irradiation treatment after viosterol; in 10 cases the patients were nauseated, even though taking viosterol, but in several of these there were definite causes that might account for the nausea.

All the usual reaction symptoms except, possibly, diarrhea are, as a rule, relieved, and there is a feeling of wellbeing from the use of viosterol. The action is probably effected in some way through the calcium-phosphorus metabolism, but there is some evidence that it may be brought about through prevention or reduction of hyperirritability of the vagus.

CURRENT NEWS AND COMMENT

Aluminum cooking utensils have no selective destructive action on the antiscorbutic vitamin of milk, according to the results of experiments carried out at Mellon Institute of Industrial Research, Pittsburgh, Pa. Milk, man's most nearly perfect food, has particular importance in the dietary of the infant and child. There has been a growing tendency to boil milk whenever it is to be used in supplemental feedings, or whenever a supply is of doubtful origin. In thus safeguarding the health of children against microorganisms and in providing for better assimilation of the proteins, mothers may be assured that when they use aluminum utensils for the preparation of milk they are not depriving this invaluable foodstuff of its antiscorbutic properties.

In the Mellon Institute experiments milk was boiled lightly for five minutes in aluminum or glass containers. Some destruction of vitamin C occurred in each case as a result of the boiling, but the metallic utensils exerted no greater action than did those of glass. Another interesting observation is that winter milk from ensilage-fed cows is practically as potent in vitamin C as the best summer milk from cows on pasturage.

Full details of the experiments will be supplied by Mellon Institute on request.

Rules Governing the Award of the George Betton Massey Prize Offered by the American Physical Therapy Association

(1) The American Physical Therapy Association announces that it will award the George Betton Massey Prize at its next meeting in Chicago in October, 1930.

(2) This prize shall consist of an embossed framed Certificate of Superior Merit, reciting the name of the successful contestant and for what the certificate is given.

(3) Each essay or paper intended for competition must be presented to the duly authorized Committee at least sixty days prior to the date of the 1930 Meeting of the Association.

(4) The prize will be awarded for the best original research, clinical or laboratory or otherwise, upon any medical or surgical subject in Physical Therapy.

(5) Essays presented cannot have been published nor the facts of the original research made known previous to this entry.

(6) All essays or papers must be typewritten, double spaced, and written on only one side of the paper.

(7) Each essay must be sent without signature, but must be plainly marked with a motto and be accompanied by a sealed envelope having on its outside the motto of the paper and within the name and address of the author. Any clue by which the authorship of any given essay or paper is made known to the Committee will disbar it from competition.

(8) It is a condition of the competition that the successful essay or a copy of the same shall remain in the possession of the Editorial Board of the American Physical Therapy Association's journal and shall first be published in its journal, *PHYSICAL THERAPEUTICS*. Other or unsuccessful essays will be returned upon application within sixty days after the award.

(9) This competition is not open to any research involving a patent or copyright, and the submission of any research work for this prize carries with it the understanding that the subject matter will remain open to free use for the general good.

(10) The Committee reserves the right to withhold the award if in its judgment no piece of research offered possesses sufficient merit. In case no dissertation is considered sufficiently meritorious no awards will be made.

(11) Essays, papers, or dissertations will be received until August first, 1930.

EDWIN N. KIME, M.D.

BURTON B. GROVER, M.D.

CURRAN POPE, M.D.

Committee.

The reaction to irradiation as a means of differentiating certain varieties of tumor is the title of an article by Arthur U. Desjardins, which appeared in the January (1930) issue of the *British Journal of Radiology*. According to Desjardins, physicians in general have the idea that Roentgen and radium irradiation are useful only for therapeutic purposes. "Prolonged experience with these agents, however, has conclusively shown that they have a distinct value for the differential diagnosis of certain varieties of tumor. Such value arises from the fundamental fact, supported by abundant and clinical evidence, that every variety of cell in the body, and every organ or structure made up largely or wholly of one variety of cell, has a specific sensitiveness to the rays emitted by a Roentgen tube or by a radio-active source such as radium element or its emanation."

The past year has witnessed further progress in radium therapy. In cancer control, the use of radium is becoming increasingly more popular, especially in the European countries. The Governments of many of the foreign countries have been large purchasers of radium during recent years. During the past year, the British Ministry of Health has called upon the people of England to raise \$2,500,000.00 to purchase radium; the Government to supply one-half of that amount. The money was readily raised and the radium distributed in at least ten different centers.

A great effort is being made to break the monopoly concerning the production of radium now controlled by a group in Belgium, who own the world's richest mines located in the Belgian Congo in Africa.

Bills have been introduced in Congress in this country asking the Government to begin the production of radium from the carnotite ores found in Utah and Colorado.

The general impression is, however, that the price of radium will remain at its present high figure until some new rich bearing ore is discovered which will compel the Belgian monopoly to meet competition. The prospect of such a "find" appears quite remote.

The Radiological Review for March (1930) contains an extremely interesting symposium on radium therapy. It is quite evident from the range of subjects that much investigational work is now being conducted on the uses of radium in the various specialties. The chief indication is cancer and the various methods suggested is an encouraging example that improved results with radium depend largely on its mode of application.

A unique part of the program which is being arranged for the ninth annual session of the American Congress of Physical Therapy is a symposium on occupational therapy as related to physical therapy. This symposium will be conducted in cooperation with the Missouri Association of Occupational Therapy and will be presented by experienced workers in the field.

Progress in Radium Therapy

The medical research council of London has issued a further report on the medical uses of radium. It states that in the eight years during which investigation promoted by the council has been in progress the general situation has been quite transformed. At the beginning there had been no systematic and comprehensive study in this country of the therapeutics of radium. Its clinical use was wholly empiric and the results were of doubtful value. Year by year knowledge has increased, methods have been defined and the results have improved. From being little more than a palliative measure for inoperable cases or a supplementary treatment following removal of the main growth, radium therapy has become a curative method of primary value in several types of cancer and in some instances is superseding purely surgical procedures. The national radium trust will bring radium treatment within reach of a far larger proportion of the population. There is scarcely any part of the body likely to be the seat of cancer for which some method of applying radium has not been devised. But this development does not mean that radium is of utility in every form of cancer.—(*Jour. A. M. A.*, Jan. 4, 1930. Vol. 94, No. 1.)

The University of Minnesota Medical School has issued invitations to a symposium on "The Kidney in Health and Disease." It will be held in Minneapolis, Minnesota, July 7 to 18. The announcement points out that no attempt will be made to present the complete accumulated knowledge of the kidney in health and disease but only those phases of anatomy, physiology and pathology and the kidney in which the knowledge has recently been extended, or in which investigative effort is intense. There is no registration fee for the course and the university offers to attempt provision of dormitory accommodations if registrations are made before June 1. All correspondence in regard to the symposium may be addressed to the Symposium, University Hospital, Minneapolis, or to Dr. Hilding Berglund at the hospital.

The League of Nations is undertaking an exhaustive study of the effects that motion pictures may produce on the eyesight of children and young people. The widespread use of the cinema with its possibilities for visual education in schools and colleges has prompted the investigation.

The study will seek to determine whether any disturbances of sight are provoked by watching a brilliantly lighted screen in absolute darkness, and the maximum time that a show can last before producing a tiring effect. The work is under the supervision of Dr. Lucien de Feo, director of the International Educational Cinematographic Institute of the League of Nations.

It is interesting to review the programs of the state meetings which have been held this spring. Several have had some valuable contributions on physical therapy while others have had none at all. The program of the Texas meeting is noteworthy for some excellent papers dealing with radium, x-ray and diathermy. This shows a certain progressiveness of which other state medical associations should take cognizance. The time has come when no medical program is complete without at least a few authoritative papers on physical therapeutics.

The 35th general meeting of the German Bunsen Society (Deutsche Bunsen-Gesellschaft) for experimental physical chemistry,

the leading German society in the physico-chemical sphere, so highly important for science and technique, was held at Heidelberg near the Rhine river from May 28th to June 1st, 1930.

Spectroscopy and Formation of Molecules was the principal theme of the deliberation. The essayists who participated in the discussions were selected by the "Ortsausschuß der Deutschen Bunsen-Gesellschaft, Heidelberg, Ploek 55"

Protests Against the Exorbitant Price of Radium

The journey of Madame Curie to the United States was followed in France with a high degree of interest, and every one has been profoundly touched by the hearty welcome that she received from President Hoover, the universities and the American press. The gram of radium which was solicited is destined, not for France, but for Poland, the native country of the widow of the French physicist. The press remarks, in this connection, that Madame Curie did not receive the gram of radium in kind but a check with which to buy it, and that she has again protested against the exorbitant price at which the metal is sold today. Since the discovery of the rich deposits of uranium in Katanga province of the Belgium Congo, the problem of supplying the world with radium appears solved, especially since radium is indestructible and will serve indefinitely to furnish emanations and radiations. It has been reported that the factory at Oolen, in Belgium, which treats the mineral brought by the shipload from Africa, has decided to place a limit on its production, in order to prevent a decline in the price, which ranges at present between 600,000 and 800,000 francs per gram. In this connection, attention has been called to the fact that the buyers of radium have heretofore been chiefly laboratories and hospitals, and, furthermore, that the wealth thus acquired by the holders of the monopoly has had its source in the public and private benevolences with which the laboratories and the hospitals are supported. If radium were sold at the much lower prices that its present actual value indicates, now that the mineral from which it is derived has been found in abundant quantities, a supply would be available not only in a few large institutions richly endowed by phil-

anthropists but in all the hospitals and laboratories of the world. The speculative profits realized by the holders of the radium monopoly are, therefore, viewed here with severe disfavor, for the reason that they are obtained at the expense of human suffering, disease and death. It has even been suggested by some that a petition be addressed to the health council of the League of Nations, requesting it to intervene in the matter. In addressing the Académie des sciences recently, Professor Matignon formulated an urgent protest on the subject. As for Madame Curie, her laboratory possesses only the radium given by Dr. Henri de Rothschild. Not to be obliged to resort to begging in order to obtain radium for the Institut de cancer, she decided to resist the demands of the radium monopoly and to manufacture radium herself. The city of Paris has granted her a plot of ground and the sum of 1,500,000 francs (60,000), for the installation of her factory, and the government has allowed her a large subsidy. She hopes, in this way, to be able to serve the cause of humanity by thus helping to lower the price of radium.—(*Jour. A. M. A.*, Jan. 4, 1930. Vol. 94, No. 1.)

The Analysis of Structure by the X-Rays

Sir William Bragg, F.R.S., whose investigations of crystalline structure by the x-rays are well known, delivered the Huxley lecture on Recent Advances in Science in Their Relation to Practical Medicine. He said that analysis of structure by the x-rays should contribute to the advance of biology and medicine, because it opened up a new direction of inquiry into the relations between the properties of matter, organic and inorganic, and of atoms and molecules. The cell had been studied by the microscope, but between the formation of matter into molecules and the complicated structure of the cell lay a region which had hitherto been outside the range of vision. After forming atoms into molecules, nature's next step in making a solid body was to group the molecules in regular array. Sometimes the attempt was highly successful and the result was a visible crystal, but the beginnings of the formations in many cases escaped human vision and had now been made clear by the x-rays. When radiation, such as light or the x-rays, was scattered by the regularly arranged molecules, the scattered radiation

proceeded in certain directions only, which showed the nature of the arrangement to which they were due. Thus the x-rays were fitted to show the peculiar and universal tendency of nature to build by the ordered array of molecules as a house is built of bricks. Cellulose was taken as an example. The work of H. Mark in Germany and of others resulted in fairly definite conclusions. Nature's plan involved, first, the formation of long chains of molecules of the dextrose type. These chains were then tied together in bundles of considerable length compared to their thickness. A fiber of cotton contained an innumerable mass of these bundles, which lay with some irregularity; but when the fiber was stretched they began to arrange themselves along its length. If the stretching was not too great, the fiber recovered itself; but if excessive, the bundles slid past one another and finally the thread broke. Thus arose an extremely remarkable view of these structures. Nature from the beginning adopted on a minute scale the human design followed in the construction of a rope. Long and short fibers were so mixed and twisted together and resisted slipping to such an extent that the whole formed a long and flexible thread of great strength. The attack on the question had now been carried to the much more complicated structure of wool and hair. Professor Bragg showed some results obtained in the textile department of Leeds University which went far to prove the parallelism between cotton and woolen fibers. He thought that the same structure would be found in nerve and muscle as in wool and hair. Thus the new methods had helped to illuminate the formation of living substances out of the original atoms and molecules.—(*Jour. A. M. A.*, Jan. 4, 1930 Vol. 94, No. 1.)

A timely and valuable article appears in the March-April issue of *The Physiotherapy Review*. The title is "Case Problems as They Affect the Work of the Physiotherapist." The author is a well known administrator, having been superintendent of the Visiting Nurse Association of Chicago for several years. The article outlines the views of one who observes the various problems with which the physiotherapist is daily confronted and attempts to suggest ways and means to cope with the situations that arise.

THE STUDENT'S LIBRARY

BOOK REVIEWS

LES RAYONS ULTRA-VIOLETS EN THERAPEUTIQUES. By *Jean Saidman, M.D.*, Pp. 840, with 192 illustrations in text; second revised edition. Paris: Gaston Doin & Cie, Publishers. Price 100 francs, 1929.

This is the second edition of a treatise on the clinical application of ultraviolet rays that has, in its previous edition, enjoyed considerable popularity among students of this energy.

This voluminous work is divided into three parts. The first part is dedicated to a cataloguing of the various sources of ultraviolet rays as they are supplied for clinical use. Various carbon, metallic and other arc lamps are described, as are also the frequently occurring quartz mercury vapor lamps. General information in respect to the measure of the quality and the quantity of the rays is included. A synopsis of the more elementary aspects of ultraviolet physics completes the section.

The second section of the book undertakes a review of the physiological action of ultraviolet rays. Just here, the author brings together a number of reported physiological actions which are neither proved nor disproved. In the majority of instances, the actions reported are in reality hypothetical expressions of opinion gathered from a not too critical assortment of publications. Ultraviolet rays are bactericidal, a phenomenon which the author has designated "heliocution." The effects of the rays on the eye are reviewed. Actinic erythema, its production, its nature and its probable significance are given considerable prominence. From these basic considerations, there follows a description of an interpretation of the action of the rays on the nervous system, the blood, the nutritive exchanges (metabolism) and on the various viscera. Especially does Saidman discuss the response of the sympathetic nervous system to the stimulation that is apparently produced by ultraviolet rays,—a continental view that is gaining more and more prominence all the while. That the sympathetic nervous system responses should be particularly emphasized by a French author is to be anticipated when the position occupied by the French in the study of sympathetic phenomena is recalled; and in all likelihood, this relation is far more reaching than is at present believed. The intensification of the pigmenting properties in Addison's disease when these subjects are exposed to ultraviolet rays is emphasized as an example of the stimulating effect of ultraviolet rays. Euphoria and symptoms of mental and physical exhilaration so obvious to the experienced clinician using ultraviolet rays are cited as further examples of the sympathetic system responses. Some mention is made of the possibility

of a relation between the increase in blood calcium following parathyroid therapy and a similar increase in the calcium content of the blood following ultraviolet ray therapy, and the similarity in the results is interpreted as a further illustration of sympathetic stimulation.

As interesting and suggestive as are the first two sections of the work, the outstanding practical value of the book appears in the third and last part. Here, the author has accumulated an encyclopaedic review of many uses of ultraviolet rays, reporting not alone his own experience and the interpretation of his own findings, but likewise the experiences of many others and their interpretations. This review supplies at once a general survey of what has been attempted in ultraviolet therapy, what has been achieved and what the promises for future investigation seem to portend. To be sure, a critical and experienced research investigator in ultraviolet phenomena will easily detect that the collection of data supplied by the author is faulty and in error in numerous citations. This is certainly to be expected in a collective effort such as the book represents; but the particular advantage of the work is the general summary which precedes each chapter in this section and which expresses in the author's concept the physiological mechanism whereby the ultraviolet rays are operative in the conditions detailed. These summaries represent a concise and studied epitome of the indications, contraindications, selection of responsive cases, causes of failure and details of technic that make an invaluable guide for the beginner in ultraviolet therapy. A vast clinical experience is reflected in these summaries, and while they may be open to occasional scientific criticism, they nevertheless present an extremely practical and in general a safe premise with which to undertake ultraviolet therapy.

An extensive bibliographic reference list concludes the work. In this list, numerous familiar names are observed, some of which are unfortunately misspelled,—a cause of annoyance to the reader and a source of difficulty to the student who undertakes the gathering of facts from the original writings.

In these days of eager interest in ultraviolet therapy, when authoritative texts are scarce and in demand, this book seems to be the nearest approach for the needs of a clinical worker who is seeking especially a practical working knowledge of actinotherapy.

An English translation of the work would no doubt be most welcomed.

LA SENSITOMETRIE CUTANEE—INTRODUCTION A L'ACTINOTHERAPIE RATIONNELLE. By *J. Saidman*, Directeur Fondateur de l'Institut d'Actinologie. Pp. 300, with 82 illustrations and 4 color plates. Price 60 francs. Paris: Gaston Doin et Cie., Publishers, 1930.

Dr. Saidman has produced another contribution to practical ultraviolet therapy. This contribution is dedicated to a study of Cutaneous Sensitometry, the measure of the sensitivity of the skin to ultraviolet rays. The form which the measurement takes is an ingenious modification of the usual procedure in which the rays are made to reach the skin through various shaped apertures in an otherwise protective shield.

As is to be expected, Saidman finds differences in the skin sensitivity to ultraviolet for age, sex, endocrine type, and in a variety of pathological conditions.

On the basis of this sensitivity, he proposes and uses a method of dosage which involves the production of different degrees of erythema.

As ingenious and thorough as the entire thesis is, it seems to stand or fall on the premise that erythema production is co-related with the curative response of an individual to ultraviolet. Undoubtedly, there are instances where this co-relation would be high; but there are additional and probably more significant instances where the co-relation is non-existent. Of the latter, the specific instance of rickets is a classical example. The cure of rickets by means of ultraviolet rays alone can be entirely achieved without actinic erythema playing any part of the cure.

In general, Saidman's work should be conducive of a worthwhile development in actino-therapy; namely, it should lead to a classification of conditions, both physiological and pathological, which show various susceptibilities to ultraviolet stimulation. And when these conditions are classified, there will no doubt emerge some important observations which will disclose other mechanisms in the operativeness of ultraviolet as an agent for the cure of disease beyond merely a well-established photochemistry of the sterols.

THE NOSE, THROAT, AND EAR AND THEIR DISEASES. An original contribution by American and European authors. Edited by *Chevalier Jackson*, M.D., Sc.D., F. A. C. S., and *George Morrison Coates*, A.B., M.D., F. A. C. S. Assisted by *Chevalier L. Jackson*, A.B., M.D. With 657 illustrations and 27 inserts in colors. Philadelphia and London. W. B. Saunders Company, 1930.

This is indeed a formidable work. The authors well express the impressions of the reviewer—and this appears at the outset in the preface—that in a systematic work by many authors one does not expect to find the degree of consistency usual in a book written entirely by one author. "Indeed it is one of the advantages of such a work that conflicting opinions by leading authorities may be presented."

The book is divided in six parts. Part I deals with the nose and accessory sinuses; Part II with the pharynx and nasopharynx; Part III, with the ear. Diseases of the Larynx are considered in Part

IV, Peroral endoscopy in Part V, and Diseases of the Hypopharynx, Esophagus and Tracheobronchial tree in Part VI.

The arrangement of the material is excellent. The illustrations help considerably in supplementing the text of the several articles. Of special value is the section on anatomy of the nose. This is so well illustrated with detailed drawings that it cannot help but be of unusual interest to the student for purposes of study and to the practitioner for purposes of reference. The section on sinusitis in children contains much of the newer information on this subject.

Part II on the pharynx and larynx includes the various affections which come under this heading. In this section the treatises on chronic granulomata of the throat and on tonsillectomy and its recent revelations are worthy of special mention. The illustrations and the colored plates are also very helpful.

The anatomy of the ear is considered in detail in Part III. The information is exhaustive and well organized. In discussing the treatment of deafness (page 495) the statement is made: "Diathermy applied to the middle ear through the external canal by the use of a suitable electrode seems at times to have a beneficent action upon the mucosa of the tympanum and to aid in the absorption of exudate and fibrous adhesions." Unfortunately, this statement must be challenged. The fact remains that there are no suitable electrodes for diathermic applications to the middle ear through the external canal. The ideal method now in vogue and one which gives a maximum heat generation in the middle and inner ear consists of applying an active electrode over the mastoid area and an indifferent electrode over the malar region on the opposite. The chapters on surgery of the middle ear and on diagnosis of intracranial complications contain a wealth of information. Not that these chapters are superior to those dealing with other subjects, but because these problems are so vital to the laryngologist at all times.

Diseases of the larynx are considered in Part IV. The drawings are helpful in illustrating technic and in showing the details brought out in writings. Photography of the larynx is a comparatively new subject. It is presented in an interesting style. Syphilis of the larynx and laryngeal tuberculosis, vital subjects at all times, are elaborated upon in detail. The subject of cancer of the larynx is presented and discussed from several angles. The illustrations of total laryngectomy are excellent and merit careful scanning.

In point of page Material, Part V is the smallest in the book. This section is devoted to preoral endoscopy, including the following divisions: direct laryngoscopy, bronchoscopy, introduction of the esophagoscope and gastroscopy.

Part VI covers the subject of diseases of the hypopharynx, esophagus and tracheobronchial tree. It is well written, exhaustive and authoritative.

The detailed index adds considerably to the value of the book. Sooner or later, a volume embracing as much as this one does, must become a means of reference for every specialist.

INTERNATIONAL ABSTRACTS

The Relation of Dosage of Radium to Age, in the Production of Amenorrhea. N. Asherson.

J. Obstet. & Gyne. Brit. Emp. 36; 778 (Winter), 1929.

The results of 98 cases of patients between the age of 21 to menopause, who were treated with radium, were studied. Asherson finds that the older the patient and the closer she is to menopause, the smaller the amount of milligram hours necessary to produce an amenorrhea. The inverse law of dosage is thus postulated that in patients between puberty and menopause with a normal size uterus, the younger the patient, the bigger the milligram hour dose of radium element necessary to produce amenorrhea. The author's summary of results shows that 1200 mgm hrs. will produce amenorrhea in patients 46 to 50 years, and 1500 to 1800 mgm. hrs. in patients 36 to 45, and a somewhat higher but not stated dosage is required for individuals who are younger. In 80 cases of menopausal menorrhagia treated with radium, and who, were subsequently followed, none developed a subsequent carcinoma of cervix or corpus, and a suggestion is made by the author offering radium as a prophylaxis against carcinoma. Certain complicating sequelae were noted in patients forty years or over but not in the younger individual, and the author urges this in support of bigger dosage in younger patients.

Study of Microbic Flora in Cervicle Epitheliomas. Its Importance for Radio Therapy. Rene Vincent and Octave Monad.

Gyne. et. Ostet., de Paris, 20:709, 1929.

The bacterial flora was studied in 166 cases of cervical malignancies before and after treatment with radium. In forty cases where the streptococcus hemolyticus was recovered from the vaginal secretions, 15 or 37.5% had infections following radium therapy, while in 76 who did not harbor this organism as part of its vaginal flora only 13 or 17% had infection complicating. The streptococci were found to be the most pathogenic when mice and guinea pigs were inoculated, but the other organisms also had some degree of pathogenicity when inoculated into these animals. A small group of patients were prophylactically treated with streptococcus vaccines before exposure to radium, but the results were rather inconsistent.

Die Bedeutung Der Massage Fuer Die Wissenschaft Und Praxis Des Arztes. (The importance of massage for science and for the general practitioner). A Mueller.

Mediz. Welt 1929, ann. 3, H. 38 (Sept.), p. 1359-1361.

Massage has an immediate effect on the movement apparatus, but only when the latter is in a defi-

nite morbid condition, namely, the condition of hypertonism. Hypertension is characterized by a locally (not centrally) induced variable increase in muscle tone associated with tenderness on pressure and hyperexcitability. Twitching of the hypertonic muscle due to touch betrays the highest degree of this increase, and is indicative of the location of the pain and identical with *Cornelius'* "nerve point". Massage combats this hypertension. Its therapeutic action is not due to a modification of the circulation, but to the fact, that compression exercised expertly, provokes a typical reaction in the affected movement apparatus which inaugurates the healing of hypertension. On the hypertonic muscle, longitudinal effleurage immediately entails a diminution of hypertonus after a transient increase of its tenderness on pressure, transverse effleurage, on the contrary, brings about a transient increase and following this a stronger and longer standing decrease. All the other effects of massage, especially those promoting circulation, are only in consequence of this. Massage is therefore a form of stimulation therapy, viz., its physical form.

According to the foregoing it is useless simply to make the effleurage along the course of the large veins and lymphatics. The thing is rather to find out the seat of the hypertension, to ascertain its always variable form and extension, and to subject the affected part or muscle to petrissage and effleurage according to this finding. The success of massage depends on the exact knowledge of the anatomical and physiological conditions of the movement apparatus, on a particular training of the tactile sense, and on a constantly and intensely active observation during examination.

Diathermiekoagulation Von Synechien Unter Verwendung Zweier Richtelektroden. (Surgical diathermy of synechiae by the use of the two directive electrodes). Eberhard Lüdecke.

Arch. f. Ohren-, Nasen- und Kehlkopfheilkd. 1929, vol. 124, H 1/2 (Nov.), p. 105-108.

Up to now an active electrode has mostly been used for electrocoagulation at the site of the disease, and an indifferent electrode as large as possible at whichever remote site of the body. Under this arrangement of the electrodes the cells near the coagulated area were also severely damaged. This drawback is avoided by using two active electrodes (directive electrodes). Here it is materially easier to define the course of the lines of flow and thus, also, the boundaries of the destructive action with regard to the environment. Such an arrangement of electrodes is used in practice for dividing synechiae between the turbinate and septum. For this purpose surgical diathermy is extraordinarily suitable, since areas divided in this manner show a materially

smaller propensity to new coalescence than do synechia severed in a bloody manner. Hence, also, the irksome, painful packing, and the use of separative pledgets can be dispensed with. Division is done by the so-called synechia-forceps whose shape is similar to that of the current angulated forceps, save that the extremities of its limbs are wider and flexible. Both limbs are insulated at their bases and connected to one pole each of the diathermy apparatus. For anesthesia, 10 per cent cocain is used which, in contrast to no novocain, alters the color of the infiltrated tissue only slightly. The results are favorable. On this line, and with the same beneficial effects, synechia between the soft palate and the pharyngeal wall are severed.

Roentgenschaedigungen Der Maennlichen Keimzeller Und Nachkommenschaft. Ergebnisse Einer Umfrage Bei Roentgenaezten U.—Technikern. (Roentgenological lesions of the male germinative cell and offsprings. Outcome of a questionnaire with radiologists and technicians in the field of radiology.) Lothar Loeffler.

Strahlenther. 1929, Bd. 34, H. 3, (Dec.) p. 735-765.

The possibility of lesions occurring in the offsprings due to roentgen rays has definitely been established by experiments on plants and animals. In man it has not yet been possible to demonstrate this. The inquiries made by the author in regard to the children of males working with x-rays have elicited no proof of any phenotypic lesions. This result agrees with the facts of genetics according to which the phenotypic appearance of hereditary lesions can take place as late as in later generations. The number of miscarriages among the wives of roentgenologically active males is small compared to the publications made till now dealing with x-rayed women. Assuming the forty-ninth year of age to be generally the upper limit of the *potentia generandi* of human males "in a social, though not physiological sense" to use the author's own terms. He states that the number of children in the marriages of radiologically strenuously active men who have married after the beginning of their radiological activity, amounts to 1.5 offspring per marriage, and to 2.1 children per marriage in fertile marriages. Thirty-one per cent of the above mentioned marriages are sterile (17 out of 55). In the presence of these sterile marriages, a lesion of the spermatozoa, that is, in 18 per cent of the 55 marriages, could be evidenced. In the total material of 110 radiologically active men, regardless of age, or duration of the occupation in x-raying work and the date of wedding, there were microscopically evidenced lesions of the spermatozoa in 20 cases, viz., 18 per cent of the observations. In 7 cases children were still begotten after the recession of the lesion of the spermatozoa. In one case it could be shown that phenotypically healthy children can also be begotten in the stage of oligospermia. The author terminates his statements by saying that the experiences collected from experiments on animals urge utmost caution in the treatment of human gonadal cells by x-rays. At all events the impor-

tance of protection against stray radiation in the conducting of x-rays is obvious.

Entzuendungsbestrahlungen Entzuendlicher Adnexerkrankungen. (Irradiations of inflammatory processes in inflammatory affections of the adnexa). Joseph S. and Karl Mayer.

Monatsschr. f. Gebh. u. Gyn. 1929, vol. 82, H. 6, p. 438-449.

In roentgen ray irradiation of inflammations of the adnexa, a distinction ought to be made between fresh processes which recede readily, and older ones which result in purulent waste. According to Heidenhain and Fried fresh cases presenting signs of acute inflammation besides fever, are most suitable for this treatment. The authors themselves at first treated all acute and chronic cases without exception. When failure was observed in the acute cases, only those were irradiated in which the acute process had cleared up and no untoward change occurred after prolonged conservative treatment. In 55 per cent (of 236 cases) success was observed:—the dropping of temperature after the irradiation and the recession of the local finding. The exudates responded favorably but there was no complete purulent waste. Of importance is the outcome of the check examinations, showing complete absence of complaints in 65 per cent of the cases. These favorable end results seem to argue in favor of irradiation. The improvement of general condition is striking. A drawback of irradiation treatment lies, no doubt, in the indispensable medical supervision which can only be performed under hospitalization. On the whole the results of roentgen ray irradiations of inflammations have yielded no uniform picture. The authors have the impression that this therapy is an addition to the therapeutic measures in use, but can only supplement, not replace the usual routine conservative methods. Further observations will possibly give more definite information in regard to the treatment of inflammatory affections of the adnexa with small x-ray doses.

Zur Therapie Der Unterleibstuberkuose Der Frau. (The treatment of abdominal tuberculosis in females). Theod. von Jaschke.

Fortschr. d. Therapie 1930, ann. 6, H. 1 (Jan.), p. 2-5.

Protein stimulothrapy, especially combined with alpine sun, can be considered as an advance in the treatment of abdominal tuberculosis of females. Roentgenotherapy also acts in a similar manner, when confined to relatively small doses, up to at most 25 per cent of the S. U. D. Their effect can only be interpreted as a general activation of the protoplasm and no influence on the pathogenic agents. Irradiation with small doses causes the break-down of lymphocytes and leucocytes; the proteins which are set free thereby; obviously set up a stimulus to the growth of the surrounding connective tissue which finally leads to the substitution of the diseased tissue by the proliferating connective tissue. The author points out repeatedly that small doses give better results than do large ones. Generally, the author administers a dose of

15 per cent of the S. U. D., and that in mild cases only once, while in severer cases this dose is repeated after six months to one year, and then only at two sittings with 7.5 per cent of the S. U. D. each. Hard irradiations are given to half of the abdomen and to half of the back in the form of distant large fields under the use of 1 mm. copper filters. After the diagnosis is made by exploratory laparotomy, roentgen irradiation is instituted. The patients are later dismissed with exact directions as to a hygienic-dietetic standard of life (including, if possible, rest in the sun). After six months he orders the patients to come back and submits them to alpine sun treatment for three weeks, combining it with a protein stimulation therapy by way of caseosan. The author has had very favorable experiences with this treatment.

Ueber Verwendung Der Jontophorese Zur Behandlung Von Erkrankungen Der Haut. (The application of ionization for the treatment of diseases of the skin). Ernst Kaestenbaum.
Dermatol. Woch., 1930, Bd. 90, No. 7, (Feb.) p. 238-243.

Ionization has often proved of great value to the author, particularly when applied under cocain-adrenalin anaesthesia. In this manner a series of superficial treatments could be given quite painlessly for the removal of tattooings, teleangiectasiae, pigmented nevi, scarifications and so forth. In acne rosacea ionization was found most effective when applied at two days' intervals. The formula was 1 to 5 per cent muriate of quinine plus 5 per cent adrenalin 1 in 1000 respectively. In acne vulgaris the author employed quinine-adrenalin and 5% ammonia; the latter requires the protection of eyes and lips and produces a particularly strong exsiccation. In defluvium capillorum (seborrhea) bimuriate of quinine and ammonia were used. The electrical intensity is generally 1 ma. per square cm. with a treatment time of from 10 to 30 minutes. Lead plates or meshed metal underlaid with soaked gauze, muslin, cellulose cotton or linen are used as electrodes. Cauterizations occur only if the electrodes are badly applied, with too high a strength of the current or too high a concentration of certain medicaments, or when the electrodes are not sufficiently moistened. Finger rings are not to be worn when hand electrodes are used, because cauterizations occur chiefly at the edges of set jewels (metals).

The Treatment of Primary Carcinoma of the Breast with Radium. Geoffrey Keynes, M.D., Cantab., F. R. C. S., Eng.
Acta radiologica, 1929, Bd. 10, Nr. 4 (November) p. 393-402.

The author during the last five years has come to regard treatment of primary carcinoma of the breast with radium needles as preferable to operation. A total of 90 patients has been treated from Aug. 1924 to April 1929, many of these having operable tumours. The dosage employed is relatively small (up to 100 mgr.) and the time of exposure long (7 days or more). The radium is distributed in two main areas; 1, the primary growth; 2, the

lymphatic drainage, including the pectoral area, axilla, infraclavicular, supraclavicular, intercostal spaces. The effect on the primary growth is usually complete after four months; if it has not completely disappeared after this time, further treatment, operation or radiological, may have to be considered. No extensive operation is ever needed. Usually no operation is performed. Enlarged lymph glands respond well to radium and usually disappear. Of the 90 patients treated, 23 are recent; of the remaining 67, 41 have been operable and 26 inoperable. A good result has been obtained in 45 of these 67, 12 of the 45 being inoperable. Patients have remained "apparently cured" up to 4½ years after treatment.

Systemisierte Atemuebung Gegen Pleuraschwarte. (Systematic respiratory exercises against pleural adhesions). Leo Klauber.

Dtsche med. Woch., 1929, Jg. 55, H. 52, (Dec.) p. 2140.

It is well known that exudative pleuritis is followed by formation of adhesions between the two leaflets of the pleura, which process reduces the respiratory capacity of the lungs. In order to do away with this condition respiratory exercises are recommended by which the sound side is attempted to be compressed and the affected one to be distended. The author has worked out the compressing and distending subsidiary postures for a particular procedure. It consists of several maneuvers as follows. The patient seats himself on the chair as far back as possible. He not only seizes the posterior leg of the chair with the hand of the healthy side, but also puts the lower extremity of the healthy side round the anterior leg of the chair. Moreover he wears non-elastic braces on the healthy side. On the sick side his arm is brought into maximal abduction, flexed in the elbow and put on the head; the lower limb of the same side is freely abducted or flexed in the knee for additional relaxation of the abdominal muscles and placed on a foot-stool. Thus an optimal and at the same time simple distension of the affected side and a fixation of the healthy one is achieved, an assistant is eventually permitted to increase the compression of the patient's thorax on the healthy side by the pressure of his hands. The respiratory exercises ought to begin only after some time has elapsed since the clearing up of the exudative phenomena. The author begins with 1 minute thrice daily (inspiration through the nose, expiration by the mouth!) and increases the respiratory exercises 15 minutes three times a day. Thus a slow release of the adhesions and an increase in the breathing capacity of the affected side is obtained, without running the risk, as happens in case of forced respiratory exercises, of producing lacerations of the tissue and hemorrhages.

Fehlerhafte Und Missbraeuchliche Anwendung Der Kuenstlichen Hoehensonne. (Erroneous and abusive application of alpine sun). I. Kowarschik.

Die arztliche Praxis 1930, ann. 4, H. 1 (Jan.), p. 7-9.

Failure to constantly increase the exposure time in the course of light treatment is one of the frequent blunders. Many physicians begin with 3 or 5 minutes, then proceed with 10 or 15 minutes and continue irradiating with this dose. Light treatment is the prototype of stimulation therapy. Any irradiation sets up a stimulation of the skin, although not always visible, to which the system responds in a definite manner. The organism accustoms itself very rapidly to the stimulus. The pigmentation due to irradiation and other factors immunize the body in a very short time, so that a mild dose which at first had evoked erythema, no longer produces reactions, though repeatedly applied. Therefore the dose is to be constantly increased in the course of an ultraviolet treatment in order to set up a physiologic stimulus. Consequently in case of generalized Light baths each irradiation should be made longer than the preceding by one or perhaps by two minutes. One eventually can reach an upper limit of stimulation. This is apparent when the skin becomes gradually insensible to the rays and finally grows absolutely immune. This condition is generally attained in from 20 to 25 irradiations. An interval of 8 days to several weeks is allowed to pass without irradiation in order that the system may recuperate its sensitivity to Light.

Another error frequently committed lies in the fact that with diseases of the internal organs, such as lungs, pleura, peritoneum, bones, joints and so forth, only the diseased foci or rather the skin over the diseased foci is irradiated. All the effects of Light on endocrine secretion, blood, metabolism and nervous system are probably brought about by way of the skin. The skin is so to speak the sensory organ for ultraviolet rays; an effect, however, is only to be obtained by irradiating the most extensive surfaces possible of sound skin, i. e., preferably the entire body. This is the essential and decisive point. Finally the author points out that the action of generalized Light baths is neither connected with erythema nor pigmentation. Consequently comparatively small light doses are sufficient.

Behandlung Gangraenöser Formen Von Mastitis Mit Ultravioletten Strahlen. (Treatment of gangrenous forms of mastitis by ultraviolet rays). Heinz Küstner.

Münchener Med. Wochenschr., 1930, Ann. 77, No. 1 (Jan.), p. 14-15.

The author had the opportunity to observe in the past year some severe forms of mastitis which resulted in gangrene. Particular individual circumstances and bacterial organisms played a certain role in these cases. One of these patients died of septic infection simulating gangrene. As the medicinal and surgical treatment agreed badly with the remaining cases, the author decided to resort to irradiation by artificial sunlight. The patients received daily alpine sun irradiation on the affected breast for 1½ or 2 minutes. The distance from the source of light was 1 meter. As soon as 24 hours after the first irradiation the picture was completely changed. The intense livid hue at the margin of the gangrenous focus assumed a pink tint, the gangrenous areas were demarcated, the margins began to separate

and the following day the skin began to slough. Six exposures were sufficient to bring about this favorable effect. The resulting extensive defects of the skin healed well under the usual treatments of ointments, aided by irradiation with the sollux lamp. The author ascribes the good result of the ultraviolet light to two factors, viz., to the fact that their effect is lethal for a great number of bacterial strains including the septic organisms instrumental to this kind of mastitis, and secondly to the local congestion which carries copious antibodies to the site of the disease.

Die Strahlenbehandlung Der Karzinome. (Irradiation of Cancer). Paul Lazarus.

Beihefte Zur Mediz. Klinik, 1929, Jg. 25, H. 10, p. 207-234.

After an exact and detailed discussion of the mode of treatment of various types of carcinomata, the author points out that irradiations are to be conducted at long distances to avoid heavier reactions. The treatments must be varied according to the general condition and the blood picture. Other therapeutic measures can be utilized during the intervals between the irradiations. Lazarus advocates the use of special building-up diets and tonics. The author mentions dietetic cures as well as treatment by irradiated organs, such as irradiated veal liver, irradiated veal spleen and irradiated veal blood. With the aid of these powdered organs, irradiated by ultraviolet light and made by the chemical works of Merck at his suggestion, the author succeeded in obtaining striking recessions of tumors, drops in temperature, gains in weight, improvement of the general condition, and absorption of ascites, also in cases which had become radio-resistant.

Unfortunately the success obtained in these cases were limited to terminal stages throughout, and was therefore only transient.

Kunstfehler Bei Licht—Und Diathermiebehandlung. (Malpractice in treatment by light and diathermy). A. Laqueur.

Aerzt. Sachverständigenzeitg., 1929, Jg. 35, No. 13 (July), p. 197-204.

The use of the mercury quartz lamp, the so-called alpine sun, plays an important part in practice. Since the formation of stronger or weaker light-erythemas is frequently aimed at therapeutically their production cannot be valued as malpractice. True, in case of very strong hyperdosage burns with blistering can occur, the run of which is luckily benign. The author emphasizes that one ought to be very cautious about dosage, especially where children are concerned; good curative effects can be obtained in children in rickets, exudative diathesis and scrofula without appearance of erythema and pigmentation. The precepts of dosage for ultraviolet light irradiation leaves still much to be desired. There must be taken into consideration the focal distance, duration of exposure, age of the burner, voltage of the lamp as well as individual sensitivity of the patient. Finally incorrect clinical appreciation of the indications may also give rise to lesions. This is especially so in hypersensitive

skin, e. g., tendency towards urticaria, certain diseases of the skin, such as weeping eczemas, which contraindicate the use of quartz light rays, just as the febrile, progressive exudative forms of pulmonary tuberculosis constitute a strict contraindication.

Other sources of light, which are poor in erythema producing ultraviolet rays, but emit plenty of luminous thermal rays instead (Sollux lamp, carbon arc reflectors, Vitalux lamp), rarely give rise to lesions. Only where the natural heat regulation processes function imperfectly, e. g., in deficiently vascularized cicatricial tissue, the application of intense heat easily produce burns. Caution is advisable in varicose ulcer of the leg, if it is surrounded by scarry, callous tissue.

More risky are lesions due to diathermy. They are for the most part third degree burns which like other burns caused by electrical current are characterized by slight painfulness and protracted healing. Directions to the patient, examination of the sense of heat and cold, exact supervision of the treatment performed by a trained staff, use of well-fitting electrode terminals, avoidance of shifting of electrodes while the current is flowing—by following these precautions burns can be avoided with almost complete security. Here, too, wrong appreciation of the indications can provoke lesions. Aside from diathermy being contraindicated in all acute infectious inflammatory processes and in tendencies to hemorrhages, great caution is to be observed in treatment of the heart, since diathermy applied in the cardiac region, may sometimes provoke an untoward reaction.

Zur Klinik Und Therapie Der Rheumatischen Infektion. (The clinical and therapeutic management of rheumatic infection). Jagic.

Wiener Med. Woch., 1930, Jg. 80, No. 1 (Jan.), p. 21-24.

The various physical therapy methods are best indicated in chronic arthritis. They must not, however, be introduced too early. The cardiovascular system should always be attended to. As long as there are tachycardia and hypotonia, radical methods of physical treatment are not to be used. Only when the cardiovascular phenomena have entirely subsided, can one gradually begin with baths and hot air. It is of particular importance to order patients who have suffered from rheumatic polyarthritis, not to spend their sick leaves in cool, wet mountainous regions, but in a warm, dry climate. The author concludes with the warning to employ physical treatment in rheumatics with certain caution, and to avoid whatever may be deleterious to the heart.

Physikalische Behandlung des Emphysems. (Physical treatment of emphysema). Franz Kirshberg.

Ztschr. f. Wissenschaftl. Bäderkunde, 1929, Jg. 4, H.2 (Nov.), p. 182-196.

Functional recoveries are frequently produced in emphysema and disturbances of circulation by the employment of physical therapy. According to Hoffbauer emphysematous people show increased in-

spiration, while expiration is not correspondingly increased. The author feels that part of the air volume taken in by deepened inspiration remains in the lungs at the end of the expiration. The volitive enforcement of expiration is only possible through the work of the abdominal musculature when the latter pushes the abdominal viscera against the slackened diaphragm at the end of the expiration, thus squeezing out the lungs from beneath. According to the author it is necessary, however, to submit the rigid thorax, also, to energetic exercises, besides having gymnastics done by the abdominal musculature. This is attained by massage of the thoracic muscles, manual compression and breathing gymnastics differentiated in the minutest details. The effect of the gymnastics of the abdominal muscles manifests itself also in mobilization of the diaphragm, which fact is one of the most important tasks of the physiotherapy of emphysema. The object in gymnastics of the abdominal muscles is to teach the patient to draw in the abdomen from the center and from beneath in order to thus press the abdominal viscera against the diaphragm. Care should be taken not to draw in the belly immediately at the beginning of expiration, and only then the subsidiary mechanic power of the abdominal muscles should come into play. Constant wear of an elastic rubber abdominal bandage will be instrumental toward the cure. The improvement of circulation is essentially aided by systematic whole massage. Clapping, tapotement and vibration carried out on the thorax of the sitting or erect patient at the end of the massage are extremely efficient. The author further recommends the surrounding of the whole of the abdomen by a suction bell alternately evacuated and filled by a water suction forcing procedure, so that the belly is deeply drawn up to the top of the bell and then pushed back by again filling the bell with air. Breathing is adjusted to this rhythmical play: inspirations ought to be made during suction of the belly, expirations while it is being pressed back; gradually the expiration-phase is more and more prolonged.

Zur Roentgentherapie Der Pende-Beule (Orient-beule, Hautleishmaniose. (On roentgen-ray treatment of Pende-boil (oriental sore, dermal leishmaniosis). M. J. Karlin.

Strahlenther., 1929, Bd. 33, H. 4 (Sept.), p. 682-690.

In three cases of Pende boil ranging from 8 to 18 months' duration, which had been treated without effect, good result was obtained by roentgen ray treatment. Since this affection is histopathologically classified as a granuloma, hence as a neoplasm sensitive to x-rays, it is logical to apply the latter in this disease, especially where other methods of treatment have failed. Technically, therefore, the same principles are to be followed which govern the therapeutics of cutaneous granulomata, i. e., hardness 150 K. V., filter 3 Al., skin dose from 30 to 50 per cent, 2-4 irradiations at from 14 to 20 days' intervals. Roentgentherapy is distinguished by its cleanliness, painlessness and shortening of treatment time.

Diathermiebehandlung Gynakologischer Entzündungsprozesse. (Diathermic treatment of gynecologic inflammatory processes). H. Heymans van Amstel.

Der Chirurg, 1929, Jg. 1, H. 20, p. 918-922.

For the purpose of a resorptive treatment in adnexitis, parametritis and pelvoperitonitis or rather pelvometritis, measures are to be applied which tend to produce the strongest hyperemia possible at the site of inflammation. In this respect let us mention: hot vaginal irrigation, hot air treatment, Priessnitz dressings, hot sitz-baths, thermophors, fango-packs and heating by electric bulbs or carbon arc-lamps. Diathermy treatment, however, by which a high frequency alternating current is conducted through the whole or a portion of the body and transformed into heat through the resistance of the tissue, seems much more convenient than the enumerated measures. (Joule's frictional heat or resistance heat). When a high frequency alternating current, even of thousands of M.A., is applied, there occurs neither irritation nor concussion of any kind in the system. It is, however, to be noted that the electrical resistance of the various tissues is a specific one. Thus fatty tissue offers a much greater resistance than skin and muscle tissue, a fact which may evoke the appearance of unwelcome infiltrations in the deeper skin layers.

For gynecologic inflammations, vaginal electrodes are used. They consist of an oval or cylindric end-piece to which is fastened a hollow ebonite handle with a thermometer, which permits the temperature observation within the vagina. The electrodes can also be placed in various positions, such as the abdomino-dorsal, abdomino-dorso-vaginal, recto-abdominal and abdomino-vaginal ones. The plate electrodes can, if necessary, be applied to the hips instead of to the back or belly for the greater penetration into the adnexa. The author mostly used the abdomino-vaginal application and at the same time varied the amperage, so that it was now and then raised to the highest endurable intensity, the vaginal temperature averaging thereat from 40 to 43 degrees C. Time of treatment usually 30 minutes. A material reduction of the convalescence time was effected by diathermy treatment. On the whole the results obtained in clinical patients were more favorable than those obtained in dispensary patients, since the resorption method yields better results when patients are quite at rest.

Weitere Erfahrungen mit der Röntgendextrocidbehandlung bosartiger Tumoren und ihr weiterer Ausbau. (Further experiences with Roentgen dextrocid treatment of malignant growths and its further improvement). Henri Hirsch.

Strahlenther., 1929, Bd. 33, H. 4 (Sept.), p. 696-703.

Though the author has not succeeded in obtaining any lasting results in the treatment of malignant growths by the above mentioned treatment, this method has procured quick retrogression of the growth, rise of the metabolism, gain in body

weight as well as material improvement of the general condition in many cases. Dextrocid is a combination of iodine-cerium to a 30 per cent dextrose and of cacodylic acid. It is injected intravenously. Eventual high temperatures, vomiting, malaise following injection will disappear after some hours. The author feels that the most essential consequence of dextrocid therapy is the peculiar sensitization to the roentgen ray irradiation this treatment produces. The effect of iodine could be a resorptive one in analogy to its action on tertiary luetic manifestations or may be also on malignant tumors. Cerium, in its quality of rare earth, allied to radioactive substances, is possessed of a particularly activating and oxydizing influence on cells. The share of cacodylic acid in the dextrocid preparation expresses itself only by a corroborant effect on blood formation, thus counteracting the bad effect caused by roentgen ray irradiation. Generally, in conformity with the patient's condition, the author injects 10-20 cubic centimeters of dextrocid previous to any roentgen ray irradiation, so that in the course of the applied roentgen ray from 100 to 120, sometimes 150 c.cm. of dextrocid are consumed. Immediately after the injection, as a rule one-third of the S. U. D. is applied. In irradiations of the upper abdominal region the author's procedure is more cautious, never administering more than 1/10 S. U. D. in one sitting after previous dextrocid injection.

Zur Behandlung Des Keloids Nach Furunkel Mit Jodiontophorese. (On treatment of keloids consecutive to furuncles by iodine iontophoresis). J. Eiger.

Munchn. med. Woch. 1929, ann. 76, Nr. 31 (Aug.) p. 1297.

The mode of application is as follows: a middle-sized, round electrode as cathode covered with a cotton swab is thoroughly steeped in a 2 per cent potassium iodide solution and placed on the keloid. The anode and the much larger electrode is put on another place, such as the back. The continuous current taken from any generator whatever (battery or dynamo) is gradually turned on and should reach the intensity of from 10 to 15 to 20 M.A. Duration of the daily repeated exposure from 10 to 20 minutes. The keloid vanishes gradually; after from 10 to 15 sittings recovery with good cosmetic effect is reached.

Behandlung Der Lumbago. (Treatment of lumbago). A. Goldscheider.

Fortschr. d. Therapie 1930, ann. 6, H. 1 (Jan.), p. 17-20.

Acute seizures of lumbago associated with marked hypersensitivity, especially when preceded by muscle strain or overstress, are to be treated by rest. Generally, however, it ought to be only of short duration (1 to 3 days). During rest use is made of medical antirheumatics and antineuralgics, and, above all, heat and eventual diaphoresis can be applied simultaneously. Later on massage and re-education are resorted to.

In case of seizures of only moderate hypersensitivity, massage and gymnastics are used; the latter, merely in the form of exercises without apparatus, are to be used from the first, such as lifting the lower limb, moving it in a circle and to the back; above all flexing the trunk forward and erecting it again, which latter movement is known to be most accompanied and hampered by pain. After a short time this reeducation is productive of excellent effect which is aided by massage. The latter is best performed in such a manner that the patient, in prone position, is given effleurage and petrissage of the spine and the adjacent region on both sides, and the small of the back is brought into lordotic curvation. Also passive movements of the lower extremities in the hip joint in various directions are indicated. Besides the effleurage, petrissage and hacking with the edge of the hand, the frictions of the skin in the affected lumbar region, carried out by means of a rough towel or loofah sponge, ought not to be neglected.

In more stubborn cases thermic treatment is to be resorted to. Electric pads, sand bags, vapor douches are here advocated; while in the chronic form, the persistent lumbar warmer is recommended. With the temporary supply of heat, regardless in which form it takes place, any stronger heating effect ought to be avoided and keen care taken that the procedure be closed by a cool washing and energetic dry rubbing, for otherwise impairments often ensue. Warmth is maintained by warm, but not sudoriferous dress (wool, flannel, cat's skin, etc.).

The same, even a better effect than by the supply of heat, may often be obtained by cold water treatment; the lumbar region or the whole of the back and the buttocks being shortly rubbed with cold water of tap water temperature and then vigorously frictioned. Neither should simultaneous hardening by daily cool washing ever be forgotten though thermic treatment is used. Excessive duration of thermic supply is detrimental—heating should be confined to 1 or 2 hours as "heating impetus," and repeated several times during the day. Fango, mud packs, paraffin applications and diathermy also belong to the more intense thermic treatments. Furthermore, contrast douches, douche-massage and massage in the hot bath as well as reeducation treatment deserve to be mentioned, and so does, finally, physical hyperthermy (by means of a hot bath followed by wrapping rugs, and finally intravenous common salt injection).

Richtlinien Fuer Die Ueberweisung Von Psoriasis-kranken In Radiumhaltige Baeder. (Directions for ordering psoriatics into radioactive health-resorts). Johann Fabry.

Med. Wett., 1929. ann. 3. Nr. 33 (Aug.) p. 1198-1199.

In psoriasis, after its symptoms are entirely or for the most part removed, sulphuretted baths and sulphurous mud baths should be used. The author assumes radium to exist in many sulphuretted baths although only in small amounts. The mud delivered in such baths contains radium only inasmuch as the

vegetable earth is kneaded into mud with sulphurous water. A sulphuretted bath cure for psoriatics should last from about 4 to 6 weeks; generally a course of two baths and one day of rest will do. During the treatment no antipsoriatic salve cure has to be used; it is sufficient to rub a mild salve into sealing off of cracked places. The bath has to be preceded by a cleaning soap bath or embrocation of the skin with a 2 per cent. resorcine spirit. After the sulphuretted bath only superficial drying. The bath cure can be aided by a drinking cure with sulphurous springs. In arthritic affections with which psoriasis may be associated, packs of the affected joints with sulphurous mud is to be considered.

Die Therapeutischen Erfolge Der Radiumstrahlen Bei Induration Penis Plastica. (The therapeutic results due to radium rays in plastic induration of the penis). Herbert Fuhs.

Strahlenther., 1929, Bd. 33, H. 4 (Sept.), p. 666-672.

This pathologic condition is characterized by solid, dorsally situated indurations of the penis, sometimes also by cord-like indurations at the level of the urethral corpus cavernosum, causing pain on erection and hampering sexual intercourse. Out of 80 cases treated with radium the author was able to demonstrate 23 cases as cured or markedly improved. Only 14 per cent did not derive any benefit. Dominici's seeds filtered by 1 mm. of brass were used. In order to discard the irritation of the skin by secondary rays the applicators together with the filters were covered by gauze or gutta-percha respectively; outwardly by a porcelain envelope and proximally plied to the portion of the skin to be irradiated. The initial dose averaged from 40-30 milligram hours. This amount of rays must, however, because it closely approaches the limit of tolerance of the very sensitive skin of the penis, gradually be reduced to from about 20 to 15 milligram hours in the irradiations first given at two and later on at four weeks intervals. According to the degree of depth of the indurations, irradiations are given by applicators of various length, from one or several incidence portals. In this manner the cross fire method proves particularly beneficial, one seed being applied each dorsally and on the one side of the penis; in case of annular and cross-shaped induration, application is also made to the other side and to the lower aspect. In order to avoid commulative effects, opposite sides ought never to be irradiated simultaneously. On the average it took from 10 to 14 irradiations to produce successful results. Above this number there is the possible danger of producing teleangiectasias, atrophies.

In case of indurations with more marked deposits of lime or ossification, no satisfactory results can be expected from radium treatment alone. Here the combination of operation and radium irradiation recommended by Kummer is indicated. It is therefore advisable to have radiologic examination carried out in any case before treatment, in order to be able to decide whether radium treatment alone or in combination with surgical interference is to be utilized.

Erfahrungen Mit Grenzstrahlen Bei Hautleiden.
(Experiences with borderline rays in diseases of the skin). Willy Gertz.

Strahlenther. 1929, Bd. 34, H. 2 (Nov.) p. 406-412.

The author considers the borderline rays up to 10 kV and the doses he employs harmless: (in weeping eczemas 250 to 300 R, in chronic forms 450 to 1000 R; in psoriasis: initial doses of 500 R, in case of strongly hyperkeratotic forms also 1000 R; in lupus vulgaris 1400 R, to be repeated after 4 days up to at least 5000 R). When applied on the face caution is to be exercised on account of strong pigmentation. The results obtained in the above mentioned affections can be called good; in acne rosacea and acne vulgaris the results are only moderate. The borderline rays prove very important in cases where one hesitates on account of the frequent irradiations to submit the patient to roentgen radiation anew. Formerly one had to resort to red and blue light therapy in this respect, whereas at present, such cases can be attacked by borderline rays after short latency.

The general adoption of borderline rays in dermatological therapeutics is, however, handicapped both by the technical shortcomings of the equipment and the marked discrepancy of judgment as to its indications. Although the borderline rays will not supplant the whole of the field of roentgen ray treatment, they will nevertheless stand their ground as the method of choice in certain dermatoses.

Finally it is to be observed that the author was successful in a case of pemphigus by using small doses of from 300 to 400 R; the excoriated areas from the ruptured blisters healing over rapidly without any new eruptions occurring on these spots.

Die Radiologische Behandlung Der Malignen Tumoren. (Radiological treatment of malignant tumors). Elis Berven.

Schweiz. med. Woch. 1929, ann. 59, H. 33 (Aug.), p. 829-831.

The author reports the effect of radiotherapy on malignant tumors of the oral cavity as applied in the Stockholm "Radiumhemmet". In treatment of carcinoma of the lips with radium puncture, the peri-

sub- and intratumoral implantation of needles containing 5 and 10 mgm. of radium element, has stood the test. Filtration by 1 mm. lead, and exposure time from 3 to 5 hours is advocated. In borderline cases and inoperable patients radium treatment is markedly superior to operative treatment. Carcinoma of the cheeks reacts biologically much more unfavorably than does carcinoma of the lips. It seems that the best method is the combination of radium irradiation and electro-endothermy. In the clinically very malignant carcinomata of the tongue electro-endothermy of the neoplasm is used, either by the method of excision with the radio knife or by endothermy which is immediately followed by radium needling. With more extensive tumors, deep radium treatment, centered from various portals of entry, is directed against the tumor and lymph nodes at a focal distance of 5 cm. From 30 to 40 gram-hour radium element are given altogether; in about 3 to 4 weeks later, electro-endothermy excision of the tumor is immediately followed by radium needling of the environment of the neoplasm. In carcinomata of the mandible the author employs a combination of radiological and surgical treatment, namely, remote radium treatment prior to the operation and later after resection of the mandible. In the clinically very malignant and rapidly metastasizing tonsillar carcinoma, the tonsil and regional lymph nodes receive from 20 to 30 gram-hour radium element, and 3 to 4 weeks later local superficial application of filtered radium tubes on the tumor, 2 mm. lead filters, 1500 to 2000 mgm. hour radium element. About three weeks after the reaction has cleared up, radium needles are implanted in the remainder of the tumor mass.

One of the affections best treated with radiotherapy is sarcomata of the tonsils. One begins with roentgen irradiation of the tonsils and regional lymph nodes with 1 to 1.5 S.U.D., spread over from 4 to 6 fractional doses, .5 mm. copper filter at 40 cm. focal distance. When the tumor has lessened within from 1 to 2 weeks to such a degree that radium treatment can easily be applied, a local application of radium tubes over the surface of the tonsils is carried out. The results of treatment are good.



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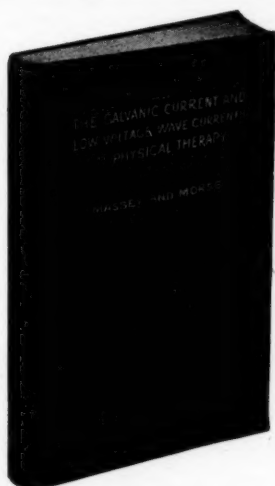
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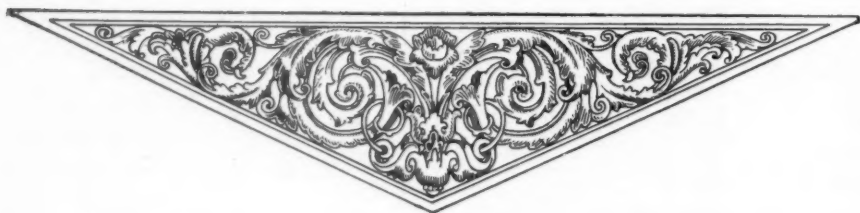
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